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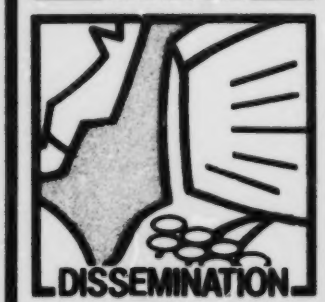

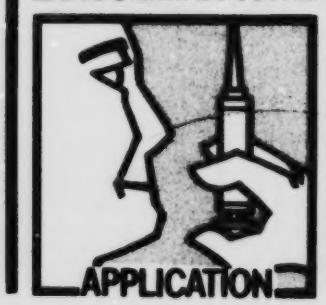

ONCOLOGY OVERVIEW

COMPLETED

SELECTED ABSTRACTS

ON

ORIGINAL

THE ROLE OF COMPUTED AXIAL TOMOGRAPHY IN THE DETECTION, DIAGNOSIS, AND THERAPY OF CANCER

MAY 8, 1979

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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SELECTED ABSTRACTS
ON

THE ROLE OF COMPUTED AXIAL TOMOGRAPHY IN DETECTION, DIAGNOSIS, AND THERAPY OF CANCER

STANLEY F. HANDEL, M.D.
Consulting Reviewer

A service of the International Cancer Research Data Bank (ICRDB) Program of the National Cancer Institute

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INTRODUCTION

This ONCOLOGY OVERVIEW on The Role of Computed Axial Tomography in Cancer Diagnosis and Treatment covers the publication years from 1976 to the most recent entries in the CANCERLINE data base. The strategy used for the ON-LINE data base search is available on request from the CIDAC office and can be entered at any MEDLARS/MEDLINE terminal system in order to obtain continuing updates in this area.

The Scope of the OVERVIEW covers the subject of the role of computed axial tomography (CAT) scanning in the diagnosis and treatment of cancer. This includes articles concerning the principles of CAT scanning, trials of CAT scanning, applications of CAT to head and body scanning, limitations and efficacy of CAT in diagnosis, the role of CAT in therapy planning and evaluations, and the future prospects of computed tomography.

This OVERVIEW was prepared by Stanley F. Handel, M.D. (Editor), Michael E. McClure, Ph.D., Ronald D. Hutchins, M.S., and Eugene M. McKelvey, M.D. of the Department of Diagnostic Radiology and the CIDAC for Diagnosis and Therapy, The University of Texas System Cancer Center, M.D. Anderson Hospital and Tumor Institute.

EDITORIAL COMMENTARY

Old timers can still recall the days before the "revolution" when computed tomography didn't exist. It's difficult to know whether things then were simpler or more difficult, but regardless, when Godfrey Hounsfield and his band of revolutionaries announced the successful mating of the x-ray tube and the computer, the old days and the old ways were in many respects, terminated. Since that time in 1972 the "revolution" has progressed in a rapid fashion.

Over the ensuing six years, at least 11 major companies have entered into the manufacture and distribution of computed tomography scanners. The first EMI scanners, still in wide usage, can perform head scanning only, and use a water-filled rubber bag about the head to equalize densities as the computer program cannot satisfactorily handle the sudden attenuation change from the head to surrounding air. Newer machines have gone from a pair of detectors to arrays of high efficiency detectors, and from scan times of four and one-half to six minutes to as little as two seconds. Images which could be viewed initially only in the axial plane are now computer reconstructed in the sagittal and coronal planes by the latest machines and computer programs. Moreover, computed tomography is now applicable to the whole body, virtually from vertex to toes. The current trend is toward machines that are satisfactory for brain and body as opposed to specialized head machines and body machines.

CAT scanning was initially a non-invasive technique. Semi-invasive or invasive approaches are now being utilized since the addition of contrast agents is now of proven value as an adjunct to computed tomography. Intravenous water-soluble contrast is now generally employed for computed scans of the head except for the diagnosis of acute intracranial hemorrhage due to trauma or for ventricular size measurements. Oral and/or intravenous water-soluble contrast agents are often important supplements to abdominal scanning. Oral contrast will distinguish bowel from abdominal masses or other normal anatomic structures. The intrathecal placement of water-soluble contrast will probably be a valuable adjunct to computed tomography of the spine and the cerebral subarachnoid cisterns.

The impact of computed tomography on health care has been dramatic, both in terms of the nature of the diagnostic information obtained and in terms of the dollar costs of computed tomography to the entire health care system. Great change has come about in the diagnostic work-up, particularly as regards the brain. Computed tomography has brought about decreases in the utilization of radionuclide scans, pneumoencephalograms, and cerebral angiograms. The sensitivity and specificity of computed tomography of the brain is such that the examination is often both a screening and a definitive diagnostic evaluation. In the posterior fossa over 90% of tumors are correctly identified and in juxtasellar lesions this figure approaches 95%, making CT scanning second only to pneumoencephalography as a diagnostic tool. By reliably delineating suprasellar tumor masses CT scanning has also enabled complex radiotherapy procedures to be carried out.

Of equal importance CT scanning has permitted the accurate evaluation of tumor response, and recurrence in post-operative patients where the distinction between tumor and surrounding edema and necrosis is often difficult using radionuclide techniques.

CT scanning has been particularly useful in outlining mass lesions of the orbit. Tumors involving the retrobulbar area, the optic nerve or the extraocular muscles as well as the paranasal sinuses can be easily defined.

Computed tomography of the thorax may have particular advantages. CT scans are capable of differentiating tumors from inflammatory changes and other benign diseases of the lung and pleura. Nodules not visible by other means may be identified and the size of mediastinal lymphadenopathy may be more clearly defined. However, the degree to which this information will add to our overall diagnostic capability is yet to be determined.

The role of CT scanning for the diagnosis of intraabdominal malignancies needs further clarification. Malignant disease of the liver, kidney and prostate can be readily diagnosed. Computed tomography appears to be the best imaging device, for the diagnosis of pancreatic masses. Unfortunately, it does not ap-

pear that diagnosis is early enough even with this tool to positively influence the outcome of pancreatic carcinoma. Computed tomography has proven to be a superb tool for diagnosing obstructive biliary disease, demonstrating the site and cause, and differentiating this from non-obstructive jaundice.

The current limitations of computed tomography should not be forgotten in the excitement of the this new technique. In many specific areas other techniques are less invasive and equal or superior to computed tomography. For example, nuclear imaging of the liver is still regarded as the most appropriate imaging method for detecting hepatic carcinoma and liver metastasis.

The final answer as to the cost effectiveness of the technique is not in; although early reports suggest that the savings brought about by rapid diagnosis, decreased reliance on other modalities, and shorter hospitizations may well offset the capital expenditures.

It seems clear that computed tomography is in a relatively early stage of development. We can expect to see further improvement in the area of image reconstruction and presentation. Resolution will also improve and scan speeds will go into the millisecond range, probably within the next two to five years. In addition, computerized ultrasonic scanners and emission scanners are now appearing on the horizon. Thus, radiographic computed tomography will be but one aspect of computed body imaging as the computer techniques find wider application in other imaging modalities.

Recent Supplementary References

1. Computed Tomography in Genitourinary Pathology. R.M. Rozanski, S.A. Kieffer and W.M. Dinn. Urology, Vol. 12, 95-105, 1978
2. Computed Tomography of the Genitourinary Tract. R.J. Stanley, S.S. Sagel, and W.R. Fair. J. Urology, Vol. 119, 780-782, 1978
3. Observations on the Medical Efficacy of Computed Tomography of the Chest and Abdomen. A.H. Robbins, R.D. Pugatch, S.G. Gerzof, L.F. Faling, W.C. Johnson, and D.H. Sewall. Am. J. Roentgenol., Vol. 131, 15-19, 1978
4. Comparison of Computed and Conventional Whole Lung Tomography in Detecting Pulmonary Nodules: A Prospective Radiologic-Pathologic Study. E.G. Schaner, A.E. Chang, J.L. Doppman, D.M. Conkle, M.W. Flye, and S.A. Rosenberg. Am. J. Roentgenol., Vol. 131, 51-54, 1978
5. Value of Computed Tomography in Radiotherapy of Lung Cancer. B. Emani, A. Melo, B.L. Carter, J.E. Munzenrider and A.J. Piro. Am. J. Roentgenol., Vol. 131, 63-67, 1978
6. Computed Tomographic Demonstration of Inferior Vena Cava Invasion in a Case of Hepatocellular Carcinoma. E.A. Zerhouni, K.H. Barth, and S.S. Siegelman. J. Computer Assist. Tomography, Vol. 2, 363-365, 1978
7. Computed Tomographic Scanning in Liver Disease. R.A. Fawcitt, W. Forbes, J.I. Sherwood, A.I. Morris, M.N. Marsh, and L.A. Turnberg. Clin. Radiol., Vol. 29, 251-254, 1978
8. Computed Tomography in the Evaluation of Musculoskeletal Neoplasms. L.A. Desantos, H.M. Goldstein, J.A. Murray and S. Wallace. Radiology, Vol. 128, 89-94, 1978
9. Computed Tomography of Musculoskeletal Disorders. J.S. Wilson, M. Korobkin, H.K. Genant, and E.G. Bovill. Am. J. Roentgenol., Vol. 131, 55-61, 1978
10. Computed Tomography of the Spine and Spinal Cord. B.C. Lee, E. Kazam and A.D. Newman. Radiology, Vol. 128, 95-102, 1978
11. Clinical Efficacy of Computed Body Tomography. J. Wittenberg, H.V. Fineberg, E.B. Black, R.H. Kirkpatrick, D.L. Schaffer, M.K. Ikeda and J.T. Ferrucci. Am.

I. PHYSICS: SYSTEM DESIGN AND IMAGE RECONSTRUCTION

A. General Principles of Design

1. HISTORICAL NOTES ON COMPUTERIZED AXIAL TOMOGRAPHY.

Hounsfield GN
Central Research Laboratories EMI Limited 248 Blythe Road Hayes, Middlesex, England
J Can Assoc Radiol; 27(3):135-142 1976

The original experiments on computerized tomography at the Central Research Laboratories of EMI are discussed. Examples trace the history of improvement in definition and process time, leading to results from the first EMI Scanner which was installed in the Atkinson Morley's Hospital in September 1971. (Author Abstract)

2. STATUS REPORT ON HOUNSFIELD'S X-RAY SCANNER.

Fischgold H
1, rue Las Cases, 75007 Paris, France
Nouv Presse Med; 5(43):2959-2964 1976

The history of the computerized tomography (CT) x-ray scanner is reviewed. Three generations of scanners have been produced in the 5 yr since their initial use in diagnosis of intracerebral lesions. There are more than 600 scanners in use throughout the world. The time of examination has been reduced from 300 to less than 3 sec, and quality of the x-ray image has been improved. Criteria for choosing the best scanner on the market are discussed. A rather complete new system of pictorial diagnostics for pathology of the brain and skull has evolved in the 5 yr of use of the CT scanner. Similar systems of diagnostic signs remain to be worked out for other areas of the body such as the thorax, abdomen, and pelvis. Recent reports in the literature on the use of CT in these areas are reviewed. The use of contrast media with CT x-ray scanning is discussed. In summary, CT has revolutionized diagnosis of cerebral lesions and replaced riskier diagnostic techniques, and appears to be very useful for diagnosis of lesions of the liver and pancreas, organs for which conventional x-ray techniques are not adequate. (5 refs)

3. HEAD AND BODY SCANNING BY COMPUTER TOMOGRAPHY.

Feindel W
Montreal Neurological Inst., Montreal, Quebec, Canada
Can Med Assoc J; 113(4):273-274 1975

Over the past 3 yr, computer tomography (CT) has changed the approach to diagnosis and management of intracranial lesions. The method uses a narrow beam of x-rays directed to scan the head in a semicircle, making a series of 4 horizontal "cuts". With each cut 28,800 readings are taken by twin gamma-sensitive detectors when the x-ray photons are transmitted to the opposite side of the head. A computer processes the information, displaying final images on a cathode screen; these provide 100 times more information than the usual x-ray film, giving detailed anatomic pictures of the normal tissue and spaces and showing a wide variety of pathologic lesions. CT makes it possible to see details in the living brain that previously were detectable only by postmortem examination.

4. BASIC PRINCIPLES OF COMPUTED AXIAL TOMOGRAPHY.

Ter-Pogossian MM
Mallinckrodt Inst of Radiology, Washington Univ Sch of Med, 510 South Kingshighway, St Louis, MO 63110
Semin Nucl Med; 7(2):109-127 1977

Computer tomography (CT) is a radiological imaging method which yields transverse tomographic images reflecting with high accuracy the spatial distribution of x-ray attenuation in the part examined. The contrast resolution achieved by CT permits the visualization of soft tissue structure heretofore invisible with conventional radiographic procedure. The CT image is reconstructed by a computer applied algorithm, from a series of x-ray attenuation measurements obtained at different angles around the subject, by means of radiation detectors. The signal to noise ratio for these measurements is optimized by reducing the contribution of scattered radiation and of system noise. The CT principle of image reconstruction is also applicable in nuclear medicine imaging, with the goal of achieving contrast improvement and quantitative assessment of radionuclide distribution over conventional "projection" techniques. In this application, however, the attenuation of the radiation in the tissues interposed between the radionuclide and the detector must be taken into account to yield quantitatively accurate images. Furthermore, the variation of the field of view of the collimator as a function of distance contributes another unwanted variable to the reconstruction process. A mathematically rigorous tomographic reconstruction which would account for these variables is unavailable for gamma ray-emitting radionuclides, although approximate solutions of that problem have led to the satisfactory images of the head. Images of larger inhomogeneous organs are less quantitative. The detection of coincidence annihilation counting of positron-emitting radionuclides allows the accurate correction for the attenuation of that radiation in tissues and permits depth independent collimation which renders these radionuclides particularly suitable for their imaging by CT. A number of CT devices designed for the imaging of positron emitting radionuclides are yielding nuclear medicine images of quality and potential clinical usefulness unequaled by more conventional projection techniques. (29 Refs) (Author Abstract)

5. PRINCIPLES OF COMPUTED TOMOGRAPHY.

Marshall CH
New York Univ. Medical Center, 550 First Ave., New York, NY 10016
Postgrad Med; 60(2):105-109 1976

Conventional radiography is limited as to the amount of information it can gather about the shape and density of an object and is often incorrect because of masking. In computed tomography (CT), thin slices of the object are radiographed perpendicularly to the plane of the slice and then reconstructed to determine the exact position of the masses of different densities. The computer is necessary because a reconstruction of a matrix of elements necessary for a head scan involves at least 25,600 elements. CT is limited however, by the stochastic nature of the radiation flux. This limit can be overcome by using higher doses of radiation although there is little room for improvement. Air or bone filled cavities, patient movement and mechanical failure during scanning present various

artifacts during scanning. Since CT provides readily available quantitative data, the use of a computer gives it a great potential for a diagnostic tool.

6. PRINCIPLES OF COMPUTERIZED TOMOGRAPHY.

Peters TM

Christchurch Hosp., Christchurch, New Zealand

Australas Radiol; 19(2):118-126 1975

A new radiographic technique, computerized axial transverse tomography, overcomes the limitations of conventional tomography, and allows accurate images of anatomical cross-section to be displayed with very fine resolution of tissue density differences. The operating principles of such machines are discussed, and a review of their capabilities and expected future developments is presented. Possible future developments include the ability to represent the entire volume of the brain by a 3-dimensional array of numbers from which any arbitrary plane may be displayed; the ability to do extremely rapid examination of the patient, possibly within 10-15 second; use in radiotherapy treatment planning, and obtaining real time visualization of a moving tissue.

7. NEW METHODS OF IMAGING IN DIAGNOSTIC RADIOLOGY.

Johns HE

Physics Div., Ontario Cancer Inst., Univ. Toronto, Toronto, Canada

Br J Radiol; 49(585):745-764 1976

A brief history of the recent developments in computer-assisted tomography (CAT) is presented. The development of whole-body scanners from the basic brain scanner, the trend towards higher-speed scanners using multiple detectors in a fan-type geometry, and some of the unsolved problems related to CAT scanners are discussed along with the potential use of whole-body scanning in radiotherapy treatment planning and in radiobiology. A review of recent developments in electrostatic imaging is presented and a new method if imaging called ionography is described in detail. Ionography offers high resolution, sensitivity, and the possibility of obtaining multiple copies giving various amounts of edge contrast. The development of solid state devices of sensitivity greater than selenium, which would have many of the properties of high pressure xenon and none of the disadvantages, would be a major breakthrough in this field. A single exposure can be used to produce a number of copies, each with a different amount of edge contrast, under the control of the radiologist. It is shown how this can be done using a closed system so that the ionography chamber needs not be opened. Some of the recent commercial developments in this field are described. It is suggested that, in the future, radiology departments may be replaced by departments of imaging, which will include all ways of obtaining diagnostic information. Such a department would be problem oriented rather than technique oriented. The need for basic scientific support by a medical physics and engineering group in such a department is emphasized. (36 refs)

8. DESIGN AND CLINICAL EXPERIENCE WITH ACTA SCANNER.

Matsui T, Luessenhop AJ, Axelbaum SP, Schellinger D

Dept. Brain, Neurosurgery, Tokyo Univ., Japan

Jpn J Clin Radiol ; 21(2):163-168 1976

Whole body automatic computerized transverse axial tomographic scanner (ACTA scanner), developed by the authors, is described. The patient lies on a electrically operated bed, and 180-degree scanning is repeated at one-degree intervals, in the flat or slanted position (-10 degrees to + 20 degrees). The x-ray absorption data are converted to visual images by means of a TV Braun tube (color, or black and white). All the data are recorded on magnetic tape for storage and recall at any time, but Polaroid pictures of the TV images can be taken routinely. Zooming techniques can also be used. Absorption values for x-rays range from 0 to 2,047. There are 16 windows in the ACTA scanner, of which 14 can be used for detailed observations. Each window can accomodate a range of absorption values. Some 3,000 colors can be chosen for each window. By changing the mean (center of x-ray absorption values), window (total range of x-ray absorption values, centering at the mean), and color, details of structure can be amplified, condensed, and clarified at will. At present, about 2,500 cases (disease examples) are on file. (8 refs)

9. PHYSICAL METHODS. (PP. 573-585)

Boag JW, Jones CH, Taylor KJ

Scientific Foundations of Oncology. Symington T, Carter RL, ed. Chicago, Year Book Medical Publishers Inc, 1976.

Recent advances in x-radiography techniques, in the study of infra-red emission, and in the area of ultrasound for locating and diagnosing tumors are reviewed. Computerized transverse axial tomography is briefly discussed. The underlying physical principles of xeroradiography which can replace film techniques in mammography are discussed. At present this technique cannot be used for radiography of the thicker sections of the body. Ionography uses a layer to gas containing some atoms of high atomic number to yield efficient photoelectric absorption and to replace selenium as an x-ray absorbing substance. The quality of the image obtained is good, but the apparatus is still in the prototype stage. The technique of computerized transverse axial tomography was developed initially for brain scanning, but is now being tried in larger body sections. Several infra-red scanners have been developed. Such a thermographic system consists of a scanning system, a detector, and a display system. Thermography of the breast is discussed together with the detection of malignant melanomas, primary osteogenic tumors, and skeletal metastases. Ultrasound operates by injecting ultrasonic pulses into the region to be explored and studying the pattern of the re-echo. Recent developments have made ultrasound a more precise tool for locating tumor deposits, particularly in sites virtually inaccessible to other remote investigative techniques. Clinical applications of ultrasound are discussed.

10. THEORY OF IMAGE RECONSTRUCTION IN COMPUTED TOMOGRAPHY.

Brooks RA, Di CHIRO G

Section of Neuroradiology, National Institutes of Health, Bethesda, Md.

Radiology; 117(3):561-572 1975

Mathematical methods are of central importance in the new technologies of radiographic and radioisotopic image reconstruction. The most important procedures are classified as Back-projection, iterative, and analytical (Two-dimensional Fourier, Filtered Back-projection). Back-projection played an important historical role but is no longer used because of sizable artifacts. Analytical methods excel in speed and accuracy when a large number of projections are available and are extensively used in x-ray imaging. Iterative reconstruction is more attractive when the number of views is limited, if noise is significant, and if additional factors, eg, gamma-ray attenuation, are present. For these reasons, iterative methods are widely used in radioisotope imaging. (Author Abstract)

11. FURTHER INVESTIGATION AND INITIAL CLINICAL USE OF ADVANCED CT DISPLAY CAPABILITY.

Glenn WV, Johnston RJ, Morton PE, Dwyer SJ
Massachusetts General Hosp., Boston, MA 02114
Invest Radiol; 10(5):479-489 1975

Experience with cadaver models in demonstrating normal coronal and sagittal computerized tomography (CT) anatomy is presented. In addition, the results of initial applications of this methodology to data from living patients are summarized. The authors review further work with small computer CT image manipulation and display capability that enable the reconstruction of good quality coronal and sagittal CT images for direct viewing and anatomical correlation. These display techniques also offer a practical solution to the problem of partial volume artifact in conventional 8- to 13-mm transverse CT images, which occur as a result of differences in tissue absorption over short vertical or z-axis distances. Such partial volume artifact makes CT evaluation difficult in those regions near the base of the skull where complex bony structures, air spaces, cerebrospinal fluid, and brain substance are encountered within the same thick CT planes. Specific potential benefits of the CT technique are triangulation of surgical lesions for removal or biopsy, a more thorough evaluation of the ventricular system, and substantially more definition of difficult areas such as basal cisternal spaces, orbits, the vicinity of the sella, and the cerebropontine angles. CT evaluation of intracranial structures will no longer have to depend on the observer's perceived reconstruction of three-dimensional morphology based only on transverse CT sections. Coronal and sagittal planes are now potentially available to contribute directly to the completeness and accuracy of an observer's three-dimensional anatomic perceptions. These capabilities should refine not only clinical CT interpretation but also the teaching of CT anatomy, i.e. neuroanatomy.

12. TUMOR VOLUME, LUXURY PERFUSION, AND REGIONAL BLOOD VOLUME CHANGES IN MAN VISUALIZED BY SUBTRACTION COMPUTERIZED TOMOGRAPHY.

Penn RD, Walser R, Kurtz D, Ackerman I.
Rush-Presbyterian-Saint Luke's Medical Center, 1753 West Congress Parkway, Chicago, IL 60612
J Neurosurg; 44(4):449-457 1976

Computer and photographic methods for producing subtractions of computerized axial tomographic (CAT) scans developed. By subtracting point for point a normal scan from one taken after iv infusion of contrast material, a picture of the contrast in the cerebral vessels is created. By this method, tumor size and degree of vascularity may be assessed. Furthermore, abnormalities in perfusion and changes in blood volume due to mass effects and edema may be detected. However, the regions of increased contrast must not be equated with regions of increased vascularity when diagnosing cerebral pathology. Subtracting scans should add to the diagnostic potential of CAT and provide a noninvasive way to study vascular changes in cerebral disease.

B. Principles of Computer Processed Image Reconstruction

13. A METHOD FOR MAKING TISSUE INHOMOGENEITY CORRECTIONS UTILIZING CT INFORMATION (MEETING ABSTRACT).

Cunningham JR, Sontag MR
Clinical Physics, Ontario Cancer Inst., 500 Sherbourne St., Toronto, Ontario M4X 1K9
Med Phys (Lancaster); 4(4): 346 1977

The information produced by a computer tomography (CT) scanner is a large array of numbers representing three dimensional structures within a region of a patient. No practical method for using this information directly for dose calculations is currently available. We have proposed a correction factor, CF = T(d',A')/T(d,A) that may be applied to dose calculations where water equivalence has been assumed. In this, "the effective tissue-air ratio" method, d and A represent depth and beam cross section while d' and A' are effective values for these same quantities obtained by taking the size, shape and position of structures into account by using processed CT numbers. A computer program has been written using the method and has been tested. Agreement was in general better than 2-3%. (no Refs)

14. CT TOMOMETRY. PART 1: INHOMOGENITIES OF TISSUE - TREATMENT PLANNING.

Kirschner H, Burmester U, Stringaris K
Radiologische Klinik der Universitat Gottingen, Grosslerstrasse 10D-3400 Gottingen, W. Germany
Strahlentherapie; 153(4):601-615 1977

Using a computed-tomography (CT) whole body scanner (Delta Scanner, Ohio Nuclear-Siemens AG), relationships between the delta-numbers (dN), chemical constitutions, and densities of human tissues and chemical compounds were studied. The scanner is calibrated so that the dN for air is -1000, the dN for water is 0, and for compact bone, +1000. For planning of radiation treatment and to compare pictures from various scanners, the dN's should have physical meaning. Therefore, the dN scale must be calibrated to read zero with pure water as the sample. For calibration purposes, standard solutions containing heavier elements (barium, iodine) should be used in the phantoms to extend the calibrated scale to higher dN's. To diagnose bone lesions and for treatment planning, an instrument with two variable anode voltages (greater than 100 kilovolts) is required. From the two scans with appropriate calibration it is possible to measure the density and the calcium concentration of the bone tissue. (12 Refs)

15. THE NONSPECIFICITY OF ABSORPTION COEFFICIENTS IN THE DIFFERENTIATION OF SOLID TUMORS AND CYSTIC LESIONS.

Latchaw RE, Gold LH, Moore JS, Payne JT
Dept. Radiology, Univ. Minnesota, Box 292 Mayo Memorial Bldg., Minneapolis, MN 55455
Radiology; 125(1):141-144 1977

Eleven lesions of the brain were analyzed and compared; they had absorption coefficients uniformly at the cerebrospinal fluid (CSF) level following contrast enhancement, and ranged from benign to malignant and solid to cystic. Grossly solid tumors may have absorption coefficients on the computed tomography (CT) scan equal to CSF even after contrast enhancement. Absorption coefficients are misleading as histological indicators and in diagnosis; it is impossible to separate cystic from non-cystic, benign from malignant, and neoplastic from non-neoplastic lesions by absorption coefficients alone. (Author abstract) (10 Refs)

16. ATTENUATION COEFFICIENTS OF VARIOUS BODY TISSUES, FLUIDS, AND LESIONS AT PHOTON ENERGIES OF 18 TO 136 KEV.

Phelps ME, Hoffman EJ, Ter-Pogossian MM
Mallinckrodt Inst Radiol, Washington Univ Sch Med, St. Louis, MO 63110
Radiology; 117(3):573-583 1975

Radioactive sources of ^{241}Am, ^{125}I, ^{153}Gd, ^{170}Tm, and ^{57}Co were used to measure the attenuation coefficient uL of various body tissues (gray and white matter, fat, liver, pancreas, and muscle), fluids (water, cerebrospinal fluid, plasma, and red blood cells), and cerebral lesions (blood clots, edematous brain tissue, and eight types of brain tumors) at 16 different energies

in the range 18-136 keV. Experimental accuracy was about 0.1-0.3% and 0.2-0.4% in the energy ranges 18-60 keV and 60-136 keV, respectively. Comparisons with values determined in vivo and in vitro with an EMI scanner showed excellent agreement. It is hoped that these findings will provide a better understanding of the photon interactions at the sensitivity level of computed tomography. (Author Abstract)

17. CORRELATION OF EFFECTIVE ATOMIC NUMBER AND ELECTRON DENSITY WITH ATTENUATION COEFFICIENTS MEASURED WITH POLYCHROMATIC X RAYS.

Phelps ME, Gado MH, Hoffman EJ
Mallinckrodt Inst Radiol, Washington Univ Sch Med, St. Louis, MO 63110
Radiology; 117(3):585-588 1975

Attenuation coefficients of nine different plastics and water were measured with EMI computed transaxial tomography (CT) and radioisotopic sources with photons of 14 to 136 keV. The EMI values were correlated with physical density, electron density and atomic number cubed (Z^3). The best correlation was obtained with electron density, the exception being the value for water. This discrepancy was explained on the basis of Z-dependent photoelectric absorption with verification from monoenergetic measurements. (Author Abstract)

18. X-RAY-TRANSMISSION COMPUTED TOMOGRAPHY.

McCullough EC, Payne JT
Mayo Clinic/Foundation, Rochester, Mn 55901
Med Phys (Lancaster); 4(2):85-98 1977

The immediate goal of clinically based x-ray-transmission computed tomography (CT) is to provide a measurement of the x-ray linear attenuation coefficient in cross section with the ultimate goal of impacting on patient management and care. To do this with the accuracy needed for clinical goals requires the careful integration of x-ray physics, detector technology, and mathematical reconstruction theory. Performance evaluation and quality assurance are necessary adjuncts to a CT scanning program. A number of investigative studies are underway. (68 Refs). (Author Abstract)

19. EXTRAPOLATION OF LINEAR ATTENUATION COEFFICIENTS OF BIOLOGICAL MATERIALS FROM DIAGNOSTIC ENERGY X-RAY LEVELS TO THE MEGAVOLTAGE RANGE FOR USE IN RADIOTHERAPY COMPUTERIZED TOMOGRAPHY TREATMENT PLANNING.

Payne WH
Univ. Texas Health Science Center, San Antonio, TX
Diss Abstr Int B; 38(4):1525-B 1977

Various dual energy algorithms were developed for use in determining the effective atomic number, atomic density, and electron density of biological substances. The methods and mathematical theory used in deriving the algorithms were presented. The quantities obtained from the algorithms were used to calculate linear attenuation coefficients at therapy energy levels. Since the elements in bone tissue have higher atomic numbers than those in other body tissues, a special algorithm for extrapolating bone tissue coefficients was developed. The fundamental extrapolation algorithm produced the quantities required to calculate higher energy coefficients up to approx the 2 million electron volt (MeV) level. For coefficients at levels above 2 MeV, additional expressions were developed and utilized. The calculated values were compared with reported values, and, except in a few instances, the extrapolated values were found to be in close agreement with the reported experimental values. Monoenergetic radioactive sources were employed to determine linear attenuation coefficients of a number of tissue equivalent materials. The energy levels of the sources were as follows: 22, 28, 47, 60, 81, 122, and 140 keV. Coefficients at 60 keV and 122 keV were used to extrapolate to coefficients at the Cobalt-60 energy (125 keV) level; these values compared favorably with measured values. Attenuation coefficients for muscle, water, and bone were extrapolated in energy increments up to 10 MeV. Close aggreement was observed in the comparison of the calculated values and previously reported calculated values. Transit dosimeter measurements of specific regions of Alderson phantom sections were made and compared with the attenuation coefficients obtained from the tomographic scans. The results indicated that more accurate isodose distribution, particularly in regions involving tissue heterogeneities, may be obtained by using the reconstructed attenuation coefficients. A Computerized Tomographic Treatment Planning system which should facilitate very accurate therapy planning was proposed. This type of system would utilize a diagnostic scanner to obtain attenuation coefficients and the scanner computer would serve as the therapy planning computer.

20. BEAM HARDENING IN X-RAY RECONSTRUCTIVE TOMOGRAPHY.

Brooks RA, Di Chiro G
Natl. Inst. Neurological Communicative Disorders Stroke, Bethesda, MD 20014
Phys Med Biol; 21(3):390-398 1976

The effects of x-ray beam hardening on the reconstructed tomogram were analyzed using computer simulation techniques. As a polychromatic x-ray beam passes through matter, low energy photons are preferentially absorbed so that the logarithmic attenuation is no longer a linear function of absorber thickness, which results in various artifacts in reconstructive tomography. Some computerized axial tomography scanners use a water bag, which surrounds the head in such a way that all x-rays traverse the same distance of tissue or water. If a water bag is used, the beam hardening in bone lowers the apparent attenuation coefficient and also produces a pseudo-cortex artifact. If a water bag is not used, beam hardening in soft tissue produces a cupping effect, a lowering of the attenuation coefficients, which is greater in the center than near the edge. In the case of the head, these two effects partially compensate and the cupping is reduced. In both cases, the effects of beam hardening can be minimized by the use of additional prefiltering and/or linearization of the detector signal.

21. ELECTRON DENSITY AND ATOMIC NUMBER DETERMINATION BY COMPUTED TOMOGRAPHY. PART I: METHODS AND LIMITATIONS. PART II: A STUDY OF COLLOID CYSTS.

Isherwood I, Pullan BR, Rutherford RA, Strang FA
Dept. Diagnostic Radiology, Univ. Manchester, Manchester, England
Br J Radiol; 50(597):613-619 1977

The methods and limitations of determining electron density and atomic number by computed tomography (CT) are discussed. The method requires scans to be obtained at two different beam energies and is subject to certain limitations in accuracy and sensitivity. Studies on 12 patients with colloid cysts suggested that the high attenuation values observed in colloid cysts are due to increased electron density and not to any increase in high atomic number elements. (9 Refs)

22. ESTIMATION OF CHEMICAL COMPOSITION AND DENSITY FROM COMPUTED TOMOGRAPHY CARRIED OUT AT A NUMBER OF ENERGIES.

McDavid WD, Waggener RG, Dennis MJ, Sank VJ, Payne WH
Dept of Radiology, Univ of Texas Health Sci Center, San Antonio, Tx 78284.
Invest Radiol; 12(2):189-194 1977

A method is presented by which computed tomography scans carried out at a number of energies may be utilized to obtain cross-sectional images of density and atomic number in addition to the conventional array of linear attenuation coefficients. This type of analysis has been carried out for various substances of biological relevance. Computer simulated reconstructions of clinical situations suggest that the method shows promise for providing additional diagnostic information and might dispense to some extent with the necessity of injecting contrast agents into the patient. (15 Refs). (Author Abstract)

23. MODULATION TRANSFER FUNCTION OF THE EMI CT HEAD SCANNER.

Bischof CJ, Ehrhardt JC
Radiation Res Lab, Dept of Radiology, Univ of Iowa, Iowa City, Io 52242
Med Phys (Lancaster); 4(2):163-167 1977

The two-dimensional modulation transfer function (MTF(nux,nuy)) has been determined for the EMI CT head scanner by measuring the point spread function (PSF) in different locations in the field of view. This PSF was obtained by scanning a fine wire supported perpendicular to the tomographic slice. Based on these MTFs, the resolving power of the EMI scanner was found to be 3.1 line pairs/cm. Our results also verify the symmetry of the system response and the uniformity of the system resolution. (6 Refs). (Author Abstract)

24. COMPTON-SCATTER TISSUE DENSITOMETRY: CALCULATION OF SINGLE AND MULTIPLE SCATTER PHOTON FLUENCES.

Battista JJ, Bronskill MJ
Physics Div., Ontario Cancer Inst., Toronto MAX 1K9, Canada
Phys Med Biol; 23(1):1-23 1978

Using analytic and Monte Carlo methods, the photon fluences which reach a Compton-scatter detector by single and multiple scattering in a water phantom of patient size were calculated. The Clarke tissue density scanner was modeled for incident monoenergetic photon energies from 300 to 2,000 kiloelectron volt (keV) and for mean scattering angles of 30 to 130 degrees. It was shown that multiple scanner contamination is an inherent limitation of the Compton-scatter method of densitometry. Improved energy resolution of the photon detector can minimize but not eliminate this problem. At a mean scattering angle of 40 degrees, the intrinsic multiple scatter contamination is reduced from 64 to 35% as the incident photon energy increases from 300 to 2,000 keV. The dose required per electron density measurement increased from 1.0 to 4.0 for a spatial resolution of approx 0.5 cm and an electron density precision of 0.5% at high incident photon energies. Forward scatter detector arrangement minimized both multiple scatter contamination and radiation dose per measurement at an incident photon energy of 1250 keV. The results confirm that the Clarke scanner design is appropriate for producing transverse tomograms suitable for radiation therapy treatment planning. (25 Refs)

25. DIGITAL PROCESSING OF IMAGES FROM A ZONE PLATE CAMERA.

Parker RP, Wilson BC
Inst. Cancer Res., Sutton, Surrey SM2 5PT, England
Phys Med Biol; 20(5):757-770 1975

A method for the digital decoding of data obtained with a gamma camera fitted with a zone plate aperture is described. Taking a line source as the object, computer simulations have been used to examine the effects of noise, solid angle variations, shape of detector and detector resolution; methods of dealing with these effects are considered. Using an Anger gamma camera and a zone plate aperture both a line source and a thyroid phantom containing $^{99m}Tc^{(1)}$ have been well reconstructed. Resolution was as good as that of a high-resolution collimator and was largely independent of the source-camera distance. In clinical situations the signal-to-noise ratio is likely to be worse than with the collimator, unless the detector can count fast enough to handle the increased geometrical efficiency. Two areas of clinical application suggested are studies where low count rate achievable with conventional collimation is the limiting factor, and in imaging small organs at low activities. The methods discussed also should be useful where tomographic information is required.

26. AN OFF-LINE IMAGE PROCESSING SYSTEM FOR DIGITAL DISPLAY IN COMPUTED TOMOGRAPHY.

Larsen LE, Evans RA
Dept of Radiology Mount Sinai Hosp Fifth Ave and 100th St New York, NY 10029
Radiology; 123:361-367 1977

Early clinical application of an off-line image processing and analysis system for digital display in conjunction with computed tomography is described. The system consists of three operational subsystems: (a) a flexible disk for digital storage of absorption values in each of eight or more tomographic planes; (b) a high-speed interactive video system which displays the tomographic plane in correct geometry with the absorption values, which serve as the pictorial elements; and (c) a paper hard copy of the absorption-values in a simulated gray-tone image of the tomographic plane in which the numerical values are the pictorial elements. Both the video and paper displays provide explicit numerical values of x-ray attenuation for each location on the tomographic plane in an image which combines analog and digital qualities. (1 Refs) (Author Abstract)

27. RIPPLE SUPPRESSION DURING RECONSTRUCTION IN TRANSVERSE TOMOGRAPHY.

Chesler DA, Riederer SJ
Massachusetts Gen. Hosp., Boston 02114
Phys Med Biol; 20(4):632-636 1975

The filter often used in transverse tomographic reconstruction was modified to produce a very small ringing in regions where the attenuation suddenly changes. A transmission device such as the EMI Scanner was computer simulated. Projections were calculated through a phantom and the phantom then reconstructed three dimensionally using different filters. With a disc phantom reconstructed with a conventional ramp filter, the ripple within the disc was 10% of the mean and the ripple just outside the disc boundary was 7.5%. The ripple within a disc reconstructed with a ramp filter and Hanning window was less than 0.2% of the mean, while the ripple beyond the boundary was less than 1.0%. Similar ripple suppression was obtained in a square phantom reconstructed with the Hanning-weighted ramp filter. The conventional ramp filter and the Hanning-weighted filter have comparable resolution due to the 2 to 1 ratio of their cutoff frequencies. To achieve the same resolution a Hanning-weighted filter must have a cutoff frequency twice as large as

an unweighted filter. Thus, the maximum allowable sampling distance for the Hanning-weighted filter is half that for the unweighted filter with the same resolution.

II. GENERAL APPLICATIONS OF HEAD SCANNING

A. Trials and Clinical Experience

28. COMPUTERIZED TOMOGRAPHY OF THE HEAD.

Baker HJ, Houser OW, Campbell JK, Reese DF, Holman CB
Mayo Clinic, 200 First St. Southwest, Rochester, Minn. 55901
JAMA; 233(12):1304-1308 1975

The basic EMI scanner system includes a scanning unit, an x-ray generator and controls, a computer with magnetic disk unit and printer, and a cathode-ray tube viewing unit. The patient's head is scanned horizontally by a tightly collimated, narrow beam of x-rays. The usual computerized tomographic examination of the head demonstrates the skull, the parenchyma of the brain, and the cerebrospinal fluid spaces and pathways. A change in the density, gross form, or size of any anatomic structure within the head may be detectable using this technique. Certain tomographic patterns, most of them associated with increased density, may be characteristic, although not necessarily specific in nature. Certain other characteristic patterns can be induced via the iv injection of iodinated contrast medium. However, some of the more common benign extra-axial lesions are difficult to identify unless considerable difference in density exists between the cerebral cortex and the lesion. Clinical experience at the Mayo Clinic with this technique has included over 8,000 cases; the tomographic results were normal in about 40%; in about 20% atrophic, degenerative, or hydrocephalic processes were found; and in the remaining 40%, parenchymal lesions including tumor, infarct, and hemorrhage were identified. Unanticipated masses and other parenchymal lesions were detected in a small but significant number of patients demonstrating few or no positive neurologic signs. Diagnostic errors including both false-positive and false-negative findings were committed in about 4% of the cases.

29. A NEW ERA IN NEURORADIOLOGY: COMPUTERIZED TRANSVERSE AXIAL TOMOGRAPHY (C.T.A.T.) (EMI-SCANNER) AND INDICATIONS FOR IT.

Collard M, Dupont H, Noel G
Universite Libre Bruxelles, C.G.T.R., 6110 Montignies-le-Tilleul, Belgium
J Radiol Electrol Med Nucl; 56(6/7):453-469 1975

Findings obtained with C.T.A.T were compared retrospectively with the findings for conventional cerebral angiography or pneumoencephalography in 468 patients. C.T.A.T findings were negative in 174 cases (37%) and positive in 294 (63%). Interpretations of C.T.A.T findings resulted in erroneous diagnoses in only 3 of these 294 cases. In 1 case, what appeared to be cerebellar cysts were really caused by a fibrous septum of the posterior fossa which formed after removal of a cystic astrocytoma. Primary tumors were found in 20 cases and metastases in 6 (5.5% of the group of 468 patients). While conventional radiological techniques demonstrate the presence of tumors indirectly, C.T.A.T shows neoplastic processes directly and differentiates between tumors and perifocal edema; it also shows tumor necrosis and makes it possible to estimate the real vol of the tumor. C.T.A.T demonstrates hydrocephalus resulting from tumors in cases in which cerebral tomography is contraindicated. Tumors which produce no changes in vascular topography and which are not visualized by conventional radiological techniques are shown directly by C.T.A.T. This technique can also be used for postoperative follow-up examinations or for following patients who have undergone radiotherapy to verify that the tumor has been completely resected or that a recurrence has developed.

30. COMPUTED TOMOGRAPHY OF THE HEAD IN ADULTS.

Lin JP
Dept. Radiology, New York Univ. Medical Center, 550 First Ave., New York, NY 10016
Postgrad Med; 60(2):113-119 1976

Computed tomography (CT) with the EMI head scanner is described. Intravenous administration of iodinated contrast medium enhances the images of intracranial neoplasms which are diagnosed either indirectly by observing changes in normal intracranial structures or directly by visualization of the neoplasm which has a different absorption coefficient from than of normal brain tissue. Meningiomas are usually denser that brain tissue because of their calcium content (20 to 300 microns). Gliomas are seen as an irregular lucent area (7 to 15 microns), similar in appearance to cerebral edema. Slow-growing gliomas may have a higher absorption coefficient than normal brain tissue because of their calcium content. Cystic gliomas are well circumscribed and have a lower absorption coefficient than non to cystic types (4-10 microns). Gliomas with necrosis are usually irregular in outline with a lucent center and a dense, irregular rim. Metastatic lesions in the brain are easily identified but may be indistinguishable from glioma unless there is evidence of multiple lesions or a history of a primary lesion elsewhere. Metastatic lesions may be either lucent or dense and are usually surrounded by extensive edema. Melanomas are usually dense. In suprasellar extension of chromophobe adenoma of the pituitary gland, the suprasellar cistern is distorted or obliterated, or both. Chromophobe adenomas may be lucent or dense with an absorption coefficient from 14 to 40. Most craniopharyngiomas contain calcium and are therefore quite dense. Posterior fossa tumors are sometimes difficult to detect because of image interference from nearby bony structures. Brainstem tumors deform the fourth ventricle, displace it posteriorally, and narrow the prepontine and cerebellopontine angle cisterns. Cerebellopontine angle tumors obliterate the cisterns on the side of the lesion and displace the fourth ventricle over the midline. Tumors within the orbital cavity are easily detected by CT. The retrobulbar space, optic nerves, muscles, and orbital globes are demonstrated using a scanning plane with 0 degrees of angulation to the orbitomeatal line and a 4 mm collimator. (15 refs)

31. COMPUTERIZED AXIAL TOMOGRAPHY OF THE HEAD (E.M.I. SCAN). CLINICAL EXPERIENCE WITH A NEW DIAGNOSTIC METHOD FOR EXAMINING THE BRAIN.

Baker L, Thomas JE
Mayo Foundation, Rochester, MN 55901
Fortschr Geb Roentgenstr Nuklearmed; 123(4):293-299 1975

Computerized axial tomography of the heat (E.M.I scan) was performed on 2 batches of 400 patients with suspected intracranial tumors, epilepsy, lesions of unknown genesis, dementia and CNS degeneration, and other indications. Cerebroparenchymal findings were normal in 40% of the cases; about 20% of the cases showed enlarged intracranial spaces; 40% of the cases showed parenchymal densities typical of lesions such as tumors, infarcts, and inflammations. Characteristic tomographic patterns (shape, locality, and/or density) were established for intracerebral and epidural

hematomas, suprasellar hypophyseal adenomas, gliomas, and cystic and polycystic tumors. The diagnosis of meningiomas and some metastases and infarcts was difficult. The incidence of false diagnosis was 4.25% in the first sample of 400 patients and 3% in the second sample. Increasing experience with tomography is expected to reduce the frequency of false diagnosis and, in many cases, will lead to the replacement of conventional diagnostic methods of examining the brain.

32. COMPUTERIZED AXIAL TOMOGRAPHY OF THE BRAIN: A NEW DIAGNOSTIC TOOL.

Pohutsky LC, Pohutsky KR
Hunter Coll. Sch. Nursing, New York, N.Y.
Am J Nurs; 75(8):1341-1342 1975

Computerized axial tomography with EMI (Electronics and Musical Instrumentation) scanner is a reliably safe diagnostic tool for producing anatomical and pathological information about the brain. The EMI scanner provides high resolution computerized axial tomography by employing an x-ray beam to map contiguous brain slices for 180 different angles, and the calculate differential tissue absorption patterns by computer projection of the original x-ray on Polaroid film. The combined use of EMI and nuclear medicine scanning provides correct diagnosis in 98% of brain lesions, permitting visualization of benign and malignant lesions by their distinctive densities, as well as mapping of their adjacent edematous tissues. The procedure is quick (20-30 minutes) painless, safe, and reduces the need for pneumoencephalograms. Other machines still in development, will be able to scan the total body.

33. COMPUTER TOMOGRAPHY OF THE BRAIN IN HAMILTON.

Banna M, Molot MJ, Kapur PL, Groves J
McMaster Univ. Medical Centre, 1200 Main St. W, Hamilton, Ontario, Canada
Can Med Assoc J; 113(4):303-307 1975

Computer tomography (CT), a new noninvasive, rapid, and easily tolerated technique of brain examination, was evaluated by an analysis of 1,000 examinations. CT is much more sensitive than conventional radiographic techniques and can resolve soft-tissue structures that differ only slightly in density. In CT the head is scanned in a series of transverse slices either 1.3 or 0.8 cm thick, with a very narrow x-ray beam. Results are provided in both a print-out and a screen image that can be photographed. The accuracy of the procedure is indicated by the fact that during one scan 28,000 readings are taken to calculate 6,400 absorption coefficients; the number of readings is doubled in a new matrix (160 x 160). The radiation dose is between 1.0-2.5 rads, which is less than that in routine x-ray examination of the skull. CT also provides direct visualization of the ventricular system. It is especially useful in differentiating intracerebral hemorrhage from infarction, and in demonstrating many brain tumors, particularly supratentorial, though enhancement with a water-soluble contrast medium injected iv is often necessary.

34. COMPUTED TOMOGRAPHY OF THE BRAIN. (PP. 3-60)

Jones JN, Schwarz HJ, Shoop JD
Current Problems in Diagnostic Radiology. Moseley RD, ed. Chicago, Yearbook Medical Publishers, Inc., 1976.

The case histories of 62 patients are discussed briefly, and the x-rays taken by computed tomography (CT) are presented for each case. Limitations of CT scanning are discussed and further uses for the technique are explored. The general technique is described and the technical procedure is discussed briefly. Tomography of normal anatomy, trauma, tumors, infections, vascular disease, atrophic brain disease, and selected pediatric abnormalities is described. The diagnosis of intracranial neoplasm by CT is at least as accurate as imaging techniques and CT permits a transaxial projection of the abnormality. Small lesions present diagnostic problems with CT. Tumors in the subarachnoid cisterns or cerebellopontine angles areas are better evaluated by tomographic pneumoencephalography. Neoplasms manifest their presence by altering the appearance of the CT scan by at least one, and often several, of the following mechanisms: mass effect, edema, abnormal absorption values, and contrast enhancement. Except for very small tumors, most neoplasms in the supratentorial area cause compression and obliteration of nearby ventricles and subarachnoid spaces, together with a contralateral shift of the midline structures such as the septum pellucidum and pineal gland. Mass effect may also be manifest as disruption of the normal cerebrospinal fluid pathways with consequent hydrocephalus. The greatest amount of edema is encountered with metastatic disease. Neoplastic lesions may contain areas of increased and/or diminished mu with respect to surrounding normal brain tissue. Constrast enhancement is the most valuable adjunct to CT in the diagnosis of neoplasia. CT offers an excellent method of following the progress of treated intracranial neoplasms. Residual or recurrent tumor will be clearly shown by contrast enhancement and any postsurgical changes are readily apparent. Despite advances in CT, the radionuclide brain scan will retain a complementary but probably less predominant role in the evaluation of intracranial neoplastic disease. (35 refs)

35. AN ANALYSIS OF THE FIRST ONE THOUSAND CEREBRAL ACTA SCANS.

Schellinger D, Axelbaum SP, Di Chiro G
Dept. Radiology, Georgetown Univ. Hosp., 3800 Reservoir Road, N.W., Washington, D. C. 20007
Fortschr Geb Roentgenstr Nuklearmed; 125(3):211-213 1976

The first one thousand cerbral scans by the ACTA-Scanner were reviewed. The scan was unequivocally positive for the presence of a mass in 61 of 87 patients with tumors. Abnormalities were defined in three ways: direct tumor visualization; inference of tumor because of ventricular, pineal or choroid plexus displacement; and tumor visualization with only contrast enhancement. The more frequent use of contrast enhancement represented the single most important factor in improving the accuracy rate. ACTA Scan was accurate in 5/16 intracerebral hematomas and 11/15 subdural hematoma. It was very accurate in evaluating the cerebro-spinal fluid containing spaces. Low and high density substances could be easily differentiated from normal brain. The data indicate that patients with even a remote chance of harboring a brain tumor should have a contrast enhanced ACTA Scan. (5 refs)

36. COMPUTER TOMOGRAPHY - EXPERIENCE WITH THE FIRST 200 CASES EXAMINED AT THE DEPT. OF NEURORADIOLOGY OF UMEA HOSPITAL.

Liliequist B, Forssell A
Rontgenavdelning 2, Umea lasarett, S-901 85 Umea, Sweden
Lakartidningen; 73(23/29):2475-2478 1976

Results of the first 200 computer tomographies performed for different cerebral lesions are presented. The tomographic finding was verified by scintigraphy, angiography, surgery, or autopsy and were in agreement with previous experiences. Primary or recurrent tumor was suspected clinically in 119 cases. The tomographic findings showed tumor in 30 cases, and non-neoplastic pathology in 9 cases. The tomographic picture was normal in 80 cases. Tomography helped distinguish between hematoma and infarction and was most reliable in the case of supratentorial tumors, while it was least reliable for gliomas and tumors in the posterior cranial fossa. Intrasellar tumors extending beyond the limits of the sella

turcica can be diagnosed by contract enhancement. The findings indicate the high value of computer tomography in the diagnosis of brain tumors. (1 ref)

37. COMPUTER TOMOGRAPHY IN INTRACRANIAL TUMORS. A COOPERATIVE STUDY OF 1658 NEOPLASMS.

Wende S, Aulich A, Kretzschmar K, Grumme T, Meese W, Lange S, Steinhoff H, Lanksch W, Kazner E
Abteilung fur Neuroradiologie, Universitatskliniken Mainz, Langenbeckstr. 1, E-6500 Mainz, W. Germany
Radiologe; 17(4):149-156 1977

The results of computerized tomography of 1,658 patients with cerebral tumors are presented. Diagnostic accuracy in this series was 98.4%. The various types of tumors (306 glioblastomas, 255 astrocytomas and oligodendrogliomas, 248 meningiomas, 212 metastases, and 200 pituitary adenomas and craniopharyngomas) are discussed and illustrated by examples. The differential diagnostic problems and the importance of additional neuroradiological procedures are discussed. (5 Refs)

38. COMPUTERIZED TRANSAXIAL TOMOGRAPHY BY MEANS OF EMI-SCANNER. PRELIMINARY RESULTS OF 1,000 OBSERVATIONS.

Collard M, Dupont HP
C.G.T.R., B 6110 Montignies-le-Tilleul, Belgium
J Belge Radiol; 58(4):289-328 1975

The development of computerized transaxial tomography (CTT) is discussed. Specific indications for CTT examination are outlined for traumatic and post-traumatic lesions, atrophy, infections, primary and secondary tumors, vascular disorders, epilepsy, and hydrocephaly. Since 1974, 1,350 patients have been examined by CTT. Of the total number of diagnoses, there were five diagnostic errors. Intracerebral tumors are manifested in CTT by an expansive mass with a displacement of neighboring structures. Meningiomas show an increased and relatively homogeneous radio-opacity. CTT permits a clear delineation of the tumor from the edematous tissue surrounding the lesion. Glioma is shown as an extensive area of radiotransparence. Other tumors that can be revealed by this method are: ependymoma, lipoma of callous bodies, and colloidal cysts of the third ventricle. Intravenous injection of contrast medium increases the radio-opacity of metastatic cancer in the early stages.

39. EARLY EXPERIENCE WITH THE EMI SCANNER FOR STUDY OF THE BRAIN.

Baker HL, Campbell JK, Houser OW, Reese DF
Mayo Clinic and Mayo Foundation, Rochester, MN
Radiology; 116:327-333 1975

Computed tomography of the head is a highly accurate new radiologic technique for the evaluation of neurologic disease. Analysis of early cases indicates that the appearance produced by CT in some conditions is unique and that increasing experience allows the neuroradiologist to predict the position and nature of disease processes with greater accuracy. (Author Abstract)

40. COMPUTERIZED TOMOGRAPHY (CT) OF THE CRANIUM BY MEANS OF EMI SCANNER.

Huenig R, Elke M, Wiggli U, Mueller HR
Abteilung fur Strahlentherapie, Universitats-Institut fur Medizinische Radiologie, Kantonsspital, 4004 Basel, Switzerland
Cancer Inf; 10(4):93-104 1975

Computerized axial x-ray tomography of the skull (EMI scanning) and experiences gained with this method are described. Glioblastomas have usually lower radiation absorption than the normal surrounding tissues, while meningiomas become visible due to their increased absorption. Highly differentiated astrocytomas often cause a displacement and/or deformation of the ventricles and a displacement of calcifications in the pinealis and in the choroidal plexus. In such cases, as well as in the case of suspected metastases with normal radiation absorption, Urografin (iv infusion) is given for contrast enhancement. Due to the very low radiation exposure, EMI scanning is suitable for follow-up and therapy control. The gonads are exposed to 0.1 mR.

B. Technical Limitations in Diagnosis

41. CRANIAL COMPUTERIZED TOMOGRAPHY: A RADIOLOGIC-PATHOLOGIC CORRELATION.

Messina AV
926 Fifth Ave., New York, NY 10021
Arch Neurol; 34(10):602-607 1977

Cranial computerized tomography (CT) studies performed on 123 patients within 2 mo before death were reviewed retrospectively and, whenever possible, compared with brain sections made in the planes corresponding to the antemortem CT studies. Patients having a CT study within 14 days before death were grouped together, as were patients having CT scans 15-60 days before death. Lesions were classified as significant misses if they measured at least 1 cm in their largest dimension and did not show up on the CT scans either directly or indirectly. The results of the correlation analysis between postmortem examination and retrospective CT findings are reported. Between 11% (using 160 x 160 matrix) and 27% (using 80 x 80 matrix) of the patients were misdiagnosed (complete miss). One-third of the entire group had one or more lesions missed, but others picked up (partial agreement). Using the 160 x 160 matrix, 55% had complete agreement, and only 38% complete agreement was obtained using the 80 x 80 matrix. In general, scan accuracy was slightly greater with a longer time interval between the scan and death. Overall, sixty lesions (42% of the total number of lesions) 1 cm or more were not identified. CT is a very sensitive neurological diagnostic tool, but its limitations should be understood. Lesions that were isodense and showed little change after administration of intravascular contrast administration accounted for the majority of significant misses in this study. (13 Refs)

42. ONE YEAR'S EXPERIENCE WITH COMPUTER TOMOGRAPHY.

Greitz T
Dept. Neuroradiology, Karolinska Sjukhuset, S-104 01 Stockholm, Sweden
Acta RadiolSuppl (Stockh); 346:7-13 1975

A brief review is given of the results of computer tomography of the head in 876 patients (mean age 48 yr, range, 2 mo-86 yr). A total of 411 patients had tumors. Overall, in these tumor cases a positive diagnosis was obtained with computer tomography in 46%: infratentorial, 36%; suprasellar, 28%; supratentorial, 51%; recurrent tumor, 43%. An uncertain diagnosis was reached in 35 tumor cases. For the entire series 45% of the examinations were negative or uncertain. Proven false negative cases, mainly tumors, comprised slightly more than 2%; by including cases with definite neurologic signs of a cerebrovascular or traumatic intracranial lesion, the figure is almost 10%. Two proven false positive diagnoses were made (thalamic tumor and recurrent cerebellar astrocytoma). False negative cases consisted almost exclusively of lesions adjacent to the bone (mainly skull base) and included one subfrontal meningioma, five posterior fossa tumors, one astrocytoma, one pontine glioma, one metastasis, four small suprasellar lesions, one craniopharyngioma, and three chromophobe pituitary adenomas. Of patients with uncertain diagnosis, five had metastases, one pinealoma, one subfrontal meningioma,

one chromophobe adenoma, one astrocytoma of the posterior fossa, three acoustic neuromas and one chiari malformation. Highest diagnostic accuracy (90% or higher) was obtained in "normal" cases, in supratentorial tumors and in ventricular dilatation or cortical atrophy.

43. COMPUTERISED AXIAL TOMOGRAPHY OF THE HEAD.

Danziger J, Bloch S, Podlas H
Dept. Radiology, Princess Nursing Home, Johannesburg, South Africa
S Afr Med J; 50(36):1398-1402 1976

In computerized axial tomography, x-rays traverse a 13 mm thick section of the head and create an image on a crystal connected to a computer which forms an image of the structures based on the intensity of the light received. The normal tomographic appearance of the brain as well as the appearance of intracerebral gliomas, metastatic deposits, meningiomas, trauma, intracerebral hemorrhage, cerebral infarction, hydrocephalus, atrophy, pituitary tumors, posterior fossa and the orbit are presented. The technique has some limitations: movement of the patient's head can produce artifacts; the presence of air in the ventricles or subarachnoid spaces, as well as metallic clips, valves, and shunt tubes may produce artifacts; small lesions close to the bone may be difficult to demonstrate with certainty. This procedure is a valuable adjunct to the existing facilities.

44. SOME LIMITATIONS OF COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF NEUROLOGICAL DISEASES.

Davis KR, Taveras JM, Roberson GH, Ackerman RH
Massachusetts General Hosp., Boston, MA 02114
Am J Roentgenol Radium Ther Nucl Med; 127(1):111-123 1976

Some of the limitations of computed tomography (CT) in the diagnosis of neurologic disease include small lesions, lesions obscured by adjoining structures, small vascular structures and detail of large vessels, cases in which the diagnosis is made but information is incomplete for treatment, cases of incorrect diagnosis, non-neoplastic lesions mistaken for neoplasms, some subdural hematomas, occasional false negative findings, and misinterpretation due to technical errors. Knowledge and use of the clinical presentation, the performance of other complementary diagnostic procedures, repeat CT scans tailored to the region of interest, and repeat serial scans may assist in reaching the proper diagnosis and diminishing potential error. Despite the limitations, the accuracy of CT may be close to 98%, excluding lesions less than 1.5 cm in diameter and those in difficult regions. In the diagnosis of cerebral infarction, accuracy is around 75%; in the diagnosis of hematomas larger than 1.0 cm in diameter, accuracy is 100% in terms of lesion discovery.

45. COMPUTERIZED CRANIAL TOMOGRAPHY. REPORT ON THE 1975 CONFERENCE OF THE GERMAN SOCIETY OF NEURORADIOLOGY, OCTOBER 2-4, 1975, HANNOVER.

Rother R
Radiol. Univ.-Klinik, Klinikum Grosshadern, Marchionini-Strasse 15, 8 Munich 70, W. Germany
Fortschr Med ; 94(6):327-328 1976

A conference report on the state of the art in computer tomography (CT) of the skull is summarized. Although the use of carotid angiography, vertebral angiography, and pneumoencephalography has been reduced by 22%, 41%, and 70%, respectively, since the introduction of CT, there are still problems in the early CT diagnosis of tumors. False negatives have been recorded only in bilateral chronic subdural hematoma and angioma. CT is especially useful in follow-up assays of brain tumor recurrences. In a composite study of 404 intracranial growths, space displacement was detected in 96.5% of the cases with native scan and in 99.3% when contrast studies were included. Only three tumors could not be demonstrated. Astrocytomas of all grades and oligodendrogliomas are associated with lower density; ependymomas, meningiomas, and pituitary adenomas are linked with high density; glioblastomas, spongioblastomas, and epidermoid masses correlated with zones of both high and low density. Contrast media increased the density in 80% of the cases. In one neuropediatric study, CT diagnosed 52 tumors in 474 patients. (no refs)

46. FALSE-NEGATIVE COMPUTERIZED TOMOGRAPHY IN BRAIN TUMOR.

Tentler RL, Palacios E
Dept. Neurology, Loyola Univ. Medical Center, Maywood, IL
JAMA; 238(4):339-340 1977

Computerized axial tomography (CT), although considered to be the most reliable means for diagnosing brain tumors, may lead to an unwarranted assumption that a tumor does not exist if it does not show up on a CT scan. The case of a patient who was misdiagnosed in this way is reported. (6 Refs)

47. SOME EXAMPLES OF FALSE NEGATIVE DIAGNOSES IN COMPUTER TOMOGRAPHY.

Peeters FL
Rontgen-Zentralabteilung, Wilhelmina Gasthuis, Ie Helmersstraat 104, Amsterdam, Netherlands
Radiologe; 17(4):171-176 1977

Four examples of false negative diagnoses in computer tomography are presented. The patients were suffering from tumors in the sella turcica, adjacent to the sella turcica and in the cerebellopontine angle. The differential diagnosis in the two patients with processes along side the sella turcica are discussed. In these patients, the clinical syndrome was characterized by ophthalmoplegia. The diagnostic reliability of computerized tomography appears to be less for these perisellar processes than for other localizations. Angiography and pneumoencephalography are the methods of choice in this type of diagnosis. (14 Refs)

48. EPIDERMOID TUMORS WITH INTRAVENTRICULAR AND SUBARACHNOID FAT: REPORT OF TWO CASES.

Laster DW, Moody DM, Ball MR
Dept. Radiology, Bowman Gray Sch. Medicine, Winston-Salem, NC 27103
Am J Roentgenol Radium Ther Nucl Med; 128(3):504-507 1977

The case histories of a 28-yr-old woman and a 38-yr-old man, each with epidermoid tumors with intraventricular and subarachnoid fat, are presented. Both patients had negative absorption values on computerized tomography. Freely movable fatty material was present within the cerebrospinal fluid pathway. Neither patient had clinical evidence of aseptic meningitis or other clinical findings attributed to rupture or leakage of epidermoid tumors. The tumor was excised surgically in the woman and she was discharged postoperatively. The two cases are discussed. (11 refs)

49. NORMAL CAT SCANS IN CRANIOPHARYNGIOMA.

Volpe BT, Foley KM, Howieson J
Dept. Neurology, Memorial Sloan-Kettering Cancer Center, New York, NY
Ann Neuro; 3(1):87-89 1978

Documentation of normal computed axial tomographic (CAT) scans in patients with craniopharyngioma is presented.

The case histories of three patients are presented; in all three cases CAT scans, with and without contrast medium, were normal. The presence of the tumor, a cystic craniopharyngioma in all three, was demonstrated by pneumoencephalography. High- or low-density lesions on CAT scans with craniopharyngiomas have been reported in the literature. The lesions reported here were isodense with brain tissue, did not enhance with contrast medium, and were not associated with intracranial calcification. Routine CAT scans should not be relied on to diagnose craniopharyngiomas. (10 Refs)

50. "DOUGHNUT" SIGN IN BRAIN SCANNING.

Tarcan YA, Fajman W, Marc J, Berg D
Emory Univ. Sch. Medicine, 80 Butler St., Southeast, Atlanta, GA 30303
Am J Roentgenol; 126(4):842-852 1976

A review of the "doughnut" sign is presented and correlated with angiography, pathology, and in some cases, computerized axial tomography (CAT) in an evaluation of its significance in the neuroradiologic evaluation of a patient. It is discussed in terms of inflammatory disease, neoplasms, cerebral infarctions, and cranial and extracranial lesions. The morphology and uptake pattern of many different brain lesions should result in the "doughnut" sign, yet, with the technique routinely used, it is observed less frequently than expected. This lack of observation is a function of geometry and resolution in the scanning apparatus. Angiography has greater physical resolution than brain scans and CAT.

51. TITANIUM CLIPS IN NEUROSURGERY FOR ELIMINATION OF ARTEFACTS IN COMPUTER TOMOGRAPHY (CT). A TECHNICAL NOTE.

von Holst H, Bergstrom M, Moller A, Steiner L, Ribbe T
Dept. Neurosurgery, Karolinska Inst., Stockholm, Sweden
Acta Neurochir (Wien); 38(1/2):101-109 1977

Experiments using titanium clips in neurosurgery to eliminate artefacts in computer tomography are presented. In vivo and in vitro tests indicate that in addition to eliminating artefacts, titanium clips are resistant to corrosion, nontoxic, easily handled, inexpensive, and visible on plain x-ray. (6 Refs)

III. PEDIATRIC APPLICATIONS OF HEAD SCANNING

52. COMPUTED TOMOGRAPHY OF THE HEAD IN CHILDREN.

Naidich TP, Kricheff II
Dept. Radiology, Montefiore Hosp. Medical Center, 111 E. 210th St., Bronx, NY 10467
Postgrad Med; 60(2):123-129 1976

Computed tomography (CT) is the method of choice for initial evaluation of any child with a greater-than-normal increase in head circumference. The procedure is painless and is frequently diagnostic so that invasive studies may be avoided and time spent in hospitals shortened. CT readily differentiates simple hydrocephalus from other cases of increased head size and also identifies the level of cerebrospinal fluid obstruction and, by implication, its etiology. The Dandy-Walker syndrome and the Arnold-Chiari malformation may be identified. Conditions arising from trauma may be defined: contusion, acute hemorrhage, acute epidural hematoma, acute subdural hematoma, intracerebral hematoma, and intraventricular hemorrhage. CT significantly aids in the initial discovery, localization, and etiologic diagnosis of brain tumors. Specific descriptions of CT findings are given for astrocytoma, brain stem glioma, medulloblastoma, craniopharyngioma, ependymoma, and pinealoma. Often the CT scan provides enough information for treatment to be started, thus again avoiding invasive studies which are difficult for children and their parents.

53. COMPUTERIZED AXIAL TOMOGRAPHY IN NEUROLOGIC DISORDERS OF CHILDREN.

Bachman DS, Hodges FJ, Freeman JM
Division of Pediatric Neurology, Johns Hopkins University, School of Medicine, Baltimore, Maryland
Pediatrics; 59(3):352-363 1977

Computerized axial tomography offers major advantages over air encephalography and angiography for studies of neurologic disorders in children. The low morbidity and the ease of the procedure permit the accurate diagnosis of intracranial pathology in situations where more invasive procedures would not be undertaken. The techniques of the procedure and its uses and limitations are emphasized in a number of neurologic problems of children. (Author Abstract)

54. CRANIAL COMPUTED TOMOGRAPHY IN INFANTS AND CHILDREN.

Harwood-Nash DC, Fitz CR, Reilly BJ
Hosp. Sick Children 555 University Ave., Toronto, Ontario M5G 1X8, Canada
Can Med Assoc J; 113(6):546-549 1975

Computed tomography was used in diagnosing intracranial lesions in nearly 300 infants and children. Two major problems were overcome in this study; the restless child was kept still, and the latex cap, was fitted closely over the infant head. In the normal infant the control grey matter had a higher absorption coefficient than did that of adults. Intracranial abnormalities were detected by their absorption coefficients and by comparison of these values with those of surrounding normal tissue, together with displacement of normal structures. There were thus three broad categories of intracranial abnormalities. Abnormalities with an average absorption coefficient similar to that of normal brain tissues include abnormally dilated ventricles, abnormally dilated sulci, subdural hematomas, cerebral neoplasms and infarction. Abnormalities with an average absorption coefficient greater than that of normal brain tissue included calcification, hematomas, neoplasms and artefacts. Abnormalities with an average absorption coefficient less than that of normal brain tissue included breakdown of normal cells, structures, or tissues, or lesions containing fat or cholesterol, or air. The specific uses in children are in detecting intracranial mass lesions, identifying the character of the lesion, and evaluation congenital cranial diseases such as cerebral dysplasia, tuberous sclerosis and leukodystrophies. This technique may soon replace or supplement standard neuroradiologic techniques in infants and children.

55. COMPUTERIZED AXIAL TOMOGRAPHY IN PAEDIATRIC NEUROLOGY AND NEUROSURGERY (MEETING ABSTRACT).

Till K
Hosp. for Sick Children, Great Ormond St., London WC1N 3JH England
Proc R Soc Med; 68(11):713-716 1975

The EMI scanner is a commercially available device for computerized axial tomography. A gently immobilized head is scanned by an extremely narrow beam of X-rays, and the energy of the emerging ray is measured and recorded. The total information is computerized to reveal the tissue density at different points of a cross-section (or "slice") of the head. The tissue densities may be printed out automatically or displayed on an oscillograph. Cases are presented of a seven-yr-old boy for whom an EMI scan showed a multilocular collection of fluid in the right temporal lobe; a nine-yr-old boy for whom an EMI scan revealed a well-defined mass of variable density in the left frontal region; a six-mo-old baby for whom

the scan showed a recurrence of bilateral subdural effusions with a high density zone in the region of recent hemorrhage. The scan not only confirmed the recurrence of the original condition but indicated that cerebral atrophy was developing and that recent hemorrhage had occurred. The scan was of immediate assistance in diagnosis. Other examples given also indicate that computerized axial tomography will greatly improve management of various intracranial disorders. The investigation is simple for use on children and the radiation dosage is small.

56. NEURORADIOLOGY AND PEDIATRIC ONCOLOGY.

Harwood-Nash DC

Div. Pediatric Neuroradiology, Hosp. Sick Children, 555 University Ave., Toronto, Ontario M5G 1X8, Canada

Pediatr Clin North Am; 23(1):29-39 1976

The techniques of ventricular tomography and pneumonotomography with adequate fixation of the infant, percutaneous selective catheter cerebral angiography (with magnification, hyperventilation, and subtraction), safe water soluble myelography compounds, and computed tomography have made possible great advances in the neuroradiological study of intercranial and intraspinal neoplasia. Contrast enhanced computed tomography is mandatory in all children in whom an intercranial neoplasm is suspected. Films are presented to illustrate various conditions. (13 refs)

57. COMPUTED TOMOGRAPHY IN CHILDREN: A NEW DIAGNOSTIC TECHNIQUE.

Harwood-Nash DC, Breckbill DL

Dept. Radiology, Hosp. Sick Children, 555 Univ. Ave., Toronto, Ontario, Canada

J Pediatr; 89(3):343-357 1976

A new diagnostic technique, computed tomography (CT) in children with neuroradiologic problems is described. CT uses x-rays as its primary tool; the computer intervenes between the resultant image and the final attenuated beam. One of the most precise diagnoses made by CT is the detection of tuberous sclerosis. Possible neoplastic changes, the subcortical tubers, and the paraventricular nodules are also clearly demonstrated. A mass brain lesion, which is clinically suspected by other neuroradiologic techniques, requires CT to establish its content. The detection of iatrogenic hematomas, the response of hydrocephalic ventricles to shunting, and the rapid growth of intracerebral neoplasms are most dramatically shown by CT. It is concluded that the effect of CT to the child, the pediatrician, and the radiologist is revolutionary, but its ultimate potential must await further radiologic experience and technical developments. (32 refs)

58. GIANT CRANIOPHARYNGIOMA EVALUATED BY COMPUTERIZED AXIAL TOMOGRAPHY.

Parent AD, Fleischer AS, Marc JA, Ball TI

Atlanta, GA

J Pediatr Surg; 12(2):251-253 1977

The case history of a 5-yr-old girl with a giant craniopharyngioma is presented. She was admitted because of progressive lethargy and headaches. Computerized axial tomography demonstrated a suprasellar cystic lesion that protruded into the third ventricle and right frontal lobe. Bifrontal craniotomy was performed and the tumor was totally removed. Her postoperative course was complicated by diabetes insipidus, sepsis, disseminated intravascular coagulopathy and pseudomembranous enterocolitis; she eventually made a full recovery. (5 refs)

59. COMPUTER ASSISTED TOMOGRAPHY IN METHOTREXATE ENCEPHALOPATHY.

Peylan-Ramu N, Poplack DG, Blei CL, Herdt JR, Vermess M, Di Chiro G

Pediatric Oncology Branch, NCI, NIH, Bethesda, MD 20014

J Comput Assist Tomogr; 1(2):216-221 1977

The use of computer assisted tomography (CAT) for detecting encephalopathy in five children (3 boys, 2 girls; ages, 4.5-13 yr) treated with monthly intrathecal or intraventricular methotrexate (12 mg/m^2/dose, where specified) for acute lymphocytic leukemia (ALL) is reported. Three of the children also received cranial irradiation (2,400 rads). Computer assisted tomography revealed areas of decreased attenuation coefficient located periventricularly and in each centrum semiovale in three cases, calcifications that were mostly in the deep and cortical gray matter in two cases, and ventricular dilatation in four cases. Contrast injection, which was used on one of these five patients as well as in another child (not affected by ALL) with MTX encephalopathy, failed to reveal enhancement. It is suggested that both base-line and follow-up CAT scans be performed on patients at risk from this syndrome. (11 Refs)

60. COMPUTERIZED TOMOGRAPHY IN THE DETECTION OF INTRACRANIAL METASTASES IN CHILDREN.

Dyment PG, Rothner AD, Duchesneau PM, Weinstein MA

Pediatric Hematology-Oncology, Pediatric Neurology, and Neuroradiology, the Cleveland Clinic Foundation, Cleveland, Ohio

Pediatrics; 58(1):72-76 1976

Computerized tomography brain scans produce sectional tomograms of the brain substance which demonstrate intracranial lesions. The procedure is safe and painless, and can be done on an outpatient basis. Three children with malignant disease had intracranial metastases demonstrated using this technique during a recent six-month period at the Cleveland Clinic. (Author Abstract)

IV. BRAIN SCANNING: ANATOMICAL AND PATHOLOGICAL CORRELATIONS IN DIAGNOSIS

A. Juxtatentorial Lesions

61. THE TENTORIUM IN AXIAL SECTION. II. LESION LOCALIZATION.

Naidich TP, Leeds NE, Kricheff II, Pudlowski RM, Naidich JB, Zimmerman RD

Dept of Radiology Washington Univ Sch of Medicine 510 S Kingshighway St Louis, MO 63110

Radiology; 123(3):639-648 1977

Most juxtatentorial lesions may be localized accurately on contrast-enhanced axial section CT scans by use of the opacified tentorial bands. Lesions that lie lateral to the lateral edge of the diverging bands are supratentorial. Lesions that lie medial to the V-shaped tentorial bands are infratentorial and/or incisural. Flattening of the tentorial border of a lesion helps to identify its location. Use of the tentorial bands identifies transincisural extension of meningioma reliably, but does not distinguish well between true transtentorial growth of meningioma and marked upward bulging of the tentorium from purely infratentorial meningioma. (4 Refs) (Author Abstract)

62. THE MEDIAL TENTORIUM AND INCISURA: NORMAL AND PATHOLOGICAL ANATOMY.

Osborn AG
Dept. Radiology, Univ. Utah, Medical Center, Salt Lake City, UT 84112
Neuroradiology; 13(2):109-113 1977

There are significant variations in the length and breadth of the tentorial incisura, its relationship to the brainstem, and in the exact course and position of the free tentorial margins. Tentorial calcification can be easily distinguished on computed tomography (CT) scans from nearby structures such as the pineal gland. Primary cerebellar as well as midbrain lesions may involve the tentorial notch depending on the size and configuration of the incisura. Large suprasellar mass lesions and pituitary adenomas with extrasellar spread may be sufficiently extensive to involve the incisural structures. On CT scans, early descending transtentorial herniation is characterized by contralateral displacement and deformation of the brainstem. With severe descending herniations, the interpeduncular cistern is obliterated as the tentorial hiatus becomes completely plugged with tissue. The obliquely sectioned posterolateral tentorial leaves of the tentorial notch are delineated on contrast-enhanced CT scans. Despite wide normal variations in the size and configuration of the tentorial hiatus, CT scans can identify the incisural margins as well as posterior tentorial leaves, facilitating precise delineation of both the normal and pathological anatomy of this structure. (8 Refs)

63. CT IN THE DIAGNOSIS OF SUPRATENTORIAL TUMORS.

Davis DO
George Washington Univ. Medical Center, Washington, DC
Semin Roentgenol; 12(2):87-108 1977

Computerized tomography (CT) detects about 98% of intracranial lesions compared with 75%-80% for radionucleotide scanning. CT is also highly useful in the analysis of a lesion. In addition to permitting localization, it often yields definitive information about the character of a mass, such as calcification, vascularity, and associated edema or hydrocephalus. The CT patterns of the following supratentorial tumors are described: astrocytomas, metastatic brain lesions, ependymomas, meningiomas, cysts (epidermoid and colloid), choroid plexus papillomas, pineal neoplasms, abscesses, and tumors arising outside the dura. The differential diagnosis of brain tumors and cerebral infarction and of central abscesses and malignant gliomas is discussed. (19 Refs)

64. COMPUTERIZED TOMOGRAPHY AS A POSSIBLE AID TO HISTOLOGICAL GRADING OF SUPRATENTORIAL GLIOMAS.

Tchang S, Scotti G, Terbrugge K, Melancon D, Belanger G, Milner C, Ethier R
Radiology Department, Montreal Neurological Institute, 3801 University Street, Montreal, Quebec, Canada
J Neurosurg; 46(6):735-739 1977

Computerized tomography (CT) is shown to be very helpful in demonstrating the presence and extent of supratentorial gliomas, particularly in combination with intravenous injection of contrast material. Certain specific density patterns were found to exist and enabled us to differentiate with confidence the low-grade gliomas from the glioblastomas. Overlapping did occur, however, as was to be expected, since histological proof was sometimes obtained by needle biopsy with its inherent doubt as to true tumor representation. Future CT techniques such as sequential scanning after intravenous injection of contrast material may further increase the usefulness of CT scans in the diagnosis and therapeutic approach to the patient with a suspected glioma. (13 Refs) (Author Abstract)

65. COMPUTERIZED TOMOGRAPHY OF INFRATENTORIAL TUMORS.

Gado M, Huete I, Mikhael M
Mallinckrodt Inst. Radiology, Washington Univ. Sch. Medicine, 510 South Kingshighway, St. Louis, MO 63110
Semin Roentgenol; 12(2):109-120 1977

Fourth ventricle and subarachnoid space alterations detected by computerized tomography (CT) in 51 posterior-fossa tumors are reviewed and compared with published data from other sources. The series included 24 cerebellar, 12 cerebellopontine angle, 7 brain stem, and 7 fourth ventricle tumors. The degree of deformity and/or displacement of the fourth ventricle is described for each tumor category, together with the degree of dilation of lateral ventricles; the appearance of the pontine, cerebellopontine angle, and quadrigeminal cisterns; and the incidence of hydrocephalus. A tumor can also be recognized on CT through alterations in the density pattern of the brain parenchyma. Typical parenchymal changes are reported for cerebellar metastases, astrocytomas, medulloblastomas, ependymomas, hemangioblastomas, meningiomas, acoustic neuromas, cholesteatomas, and brain stem gliomas. (9 Refs)

66. PRIMARY TUMORS AND OTHER MASSES OF THE CEREBELLUM AND FOURTH VENTRICLE: DIFFERENTIAL DIAGNOSIS BY COMPUTED TOMOGRAPHY.

Naidich TP, Lin JP, Leeds NE, Pudlowski RM, Naidich JB
Dept. Radiology, Mallinckrodt Inst. Radiology, 510 South Kingshighway, St. Louis, MO, 63110
Neuroradiology; 14(4):153-174 1977

A total of 73 primary lesions of the cerebellum and fourth ventricle were analyzed by computed tomography (CT) to establish criteria for identifying the location and histology of tumors. In most cases, tumors of the fourth ventricle were centrally located, had a halo, and were not associated with a separately identifiable, displaced fourth ventricle. Lesions of the vermis were usually midline but eccentrically situated, had or lacked a halo, and were associated with a separately identifiable, displaced fourth ventricle. Tumors of the cerebellar hemispheres are usually eccentric in location, lack a halo and displace the fourth ventricle. The CT appearances of ependymomas, classical medulloblastomas, cerebellar sarcomas, fibromas, astrocytomas, hemangioblastomas, cerebellar abscesses are described. The differential diagnosis of these lesions is considered, and the accuracy of CT diagnosis and neuropathological correlations are discussed. The results of this analysis indicate that the criteria for diagnosing lesion location and histology by CT are reliable.

67. COMPUTED TOMOGRAPHY: EVALUATION OF THE POSTERIOR THIRD VENTRICLE.

Messina AV, Potts DG, Sigel RM, Liebeskind AL
Department of Radiology, Section of Neuroradiology, New York Hospital-Cornell University Medical Center, New York, NY
Radiology; 119(3):581-592 1976

The normal computed tomography (CT) appearances of the posterior third ventricle and related structures are presented. Seventy-six patients with lesions directly involving this ventricle were studied by CT, and results of other neuroradiological procedures evaluated. Primary tumors, metastases, hematomas, infarcts, and cysts may be reliably distinguished by CT, particularly if contrast enhancement is utilized. Size and density resolution limit the direct visualization of the aqueduct of Sylvius; stenosis however may be inferred. Small infarcts may be difficult to demonstrate by the

use of CT scans without contrast enhancement, yet be shown by isotope scans. (Author Abstract)

68. COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF POSTERIOR FOSSA LESIONS.

Baker HL, Houser OW
Mayo Clinic and Mayo Foundation, 200 First St. SW, Rochester, MN 55901
Radiol Clin North Am; 14(1):129-147 1976

Of 3,500 cases examined by computed tomography (CT) of the head, reviewed to identify patients who had symptoms and signs suggestive of neurologic disease in the posterior fossa, 348 such cases (about 10%) were found. The scans were reviewed to determine the character of lesions that could be detected and the accuracy of the neuro-radiologic diagnosis. Overall, 16 errors were made (4.6%, 13 false negatives and 3 false positives). False negatives included nine tumors, two infarcts, and two arteriovenous malformations. Four of the tumors and the two arteriovenous malformations were small and caused no visible alterations in density even when analyzed retrospectively. In the remaining seven cases, specific findings either were overlooked or were obscured by artifacts, and, therefore, the diagnosis was not made. The three false positive diagnoses were made through a misinterpretation of density changes that were artifactual. No changes in the intracranial absorption coefficients were detected in 109 cases. Abnormal changes were evident in 226 cases in which structural lesions were subsequently found. Many lesions had a characteristic appearance, but in certain clinical situations (searches for metastatic disease, acoustic neuromas, meningiomas, aneurysms of the basilar artery, and arteriovenous malformations), the injection of iv contrast medium was helpful, or even essential, for diagnostic success. It is suggested that because the prominence of clinical signs and symptoms is not always an accurate index to the presence of structural alteration of the posterior fossa, this portion of the cranium should be included in every CT study.

69. COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF EXTRA-AXIAL POSTERIOR FOSSA MASSES.

Naidich TP, Lin JP, Leeds NE, Kricheff II, George AE, Chase NE, Pudlowski RM, Passalaqua A
Department of Radiology of Montefiore Hospital, Albert Einstein College of Medicine, Bronx, New York
Radiology; 120(2):333-339 1976

Extra-axial posterior fossa masses can be diagnosed reliably by computed tomography (CT) in most cases. Acoustic and trigeminal neurinomas, meningiomas, cholesteatomas, and other extra-axial masses can usually be distinguished from intra-axial masses by asymmetric widening of the basal subarachnoid spaces, bone destruction, continuity of the tumor mass with the tentorium or bone, and more sharply defined margins. Multiple-cut study of the posterior fossa improved visualization of the fourth ventricle and basal cisterns. Interpretation of cisternal changes in association with changes in the fourth ventricle and abnormal attenuation coefficients permits accurate diagnosis of posterior fossa masses. (Author Abstract)

B. Juxtasellar Lesions

70. COMPUTED TOMOGRAPHY IN THE DETECTION OF JUXTASELLAR LESIONS.

Reich NE, Zeich JV, Alfidi RJ, Meaney TF, Duchesneau PM, Weinstein MA
Department of Radiology, Cleveland Clinic Foundation, Cleveland, Ohio
Radiology; 118(2):333-335 1976

One thousand consecutive computed tomograms were reviewed to determine the accuracy of the procedure in the detection of juxtasellar lesions. The detection rate was compared to those of plain skull films, radionuclide studies, angiography, and pneumoencephalography. Computed tomography was slightly superior to angiography and was surpassed only by pneumoencephalography, both of which are invasive procedures which carry a definite risk. The data indicated that computed tomography is the screening method of choice in the detection of juxtasellar masses.

71. COMPUTED TOMOGRAPHY OF INTRA- AND JUXTASELLAR LESIONS. A RADIOLOGICAL STUDY OF 108 CASES.

Gyldensted C, Karle A
Univ. Dept. Neuroradiology, Rigshospitalet, DK-2100 Copenhagen, Denmark
Neuroradiology; 14(1):5-13 1977

The value of computed tomography (CT) in the initial diagnosis and follow-up of intra- and juxtasellar lesions was investigated. The diagnostic accuracy of fine matrix CT, carotid angiography, pneumoencephalography (PEG) and plain skull films were compared. The possibility of using CT to establish the tumor type was studied. The case material consisted of 108 patients referred for neurological examination with the suspicion of an intra- or juxtasellar lesion. The final diagnoses of 61 cases with CT positive for juxtasellar tumor included pituitary adenomas (37), optic and hypothalamic gliomas (8), craniopharyngiomas (7), epidermoid tumors (4), arachnoid cysts (3), 1 sellar meningioma, and 1 chordoma. Faulty CT diagnosis of tumor was made once, an incorrect interpretation of CT findings occurred twice, and unsatisfactory CT occurred six times. No tumor was found using CT in 38 cases. In comparing CT with the other diagnostic methods, CT had the highest accuracy, but differed statistically only from diagnoses made using carotid angiography. CT is the superior method when compared with the more unpleasant methods of angiography and PEG. However, angiography is necessary in cases of arterial aneurysms and other vascular malformations of the sellar area and PEG is the preferred method to demonstrate intrasellar cisternal herniation and communicating cysts. (11 Refs)

72. COMPUTERIZED TOMOGRAPHY IN THE DIAGNOSIS OF SELLAR AND PARASELLAR LESIONS.

Leeds NE, Naidich TP
Albert Einstein Coll. Medicine, Montefiore Hosp. and Medical Center, 111 East 210th St., Bronx, NY 10467
Semin Roentgenol; 12(2):121-135 1977

Criteria for the visualization of sellar and parasellar lesions by computerized tomography (CT) are summarized, and the CT appearances of 84 documented lesions are described. These include pituitary adenomas, craniopharyngiomas, suprasellar meningiomas, chiasmal gliomas, germinomas, metastases, colloid cysts, and third ventricular tumors (Grades I and II astrocytomas); patients with an empty sellar syndrome and parasellar herniations are also presented. Although purely intrasellar lesions (microadenoma, tiny aneurysm) cannot be demonstrated, CT permits a correct diagnosis in many patients. At Montefiore Hospital, CT is used as the initial examination for evaluating any patient with a potential suprasellar mass. In patients with a suprasellar mass documented by CT, angiography is performed to determine the exact relationship of the mass to the circle of Willis and to demonstrate any vascular displacement or arterial encasement that might complicate the surgical treatment of the lesion. (15 Refs)

73. EVALUATION OF SELLAR AND PARASELLAR MASSES BY COMPUTED TOMOGRAPHY.

Naidich TP, Pinto RS, Kushner MJ, Lin JP, Kricheff II, Leeds NE, Chase NE

Department of Radiology, Montefiore Hospital and Medical Center, 111 East 210th Street, Bronx, New York 10467

Radiology; 120(1):91-99 1976

Computed tomography is the method of choice for initial evaluation of patients with potential suprasellar masses. In our experience, CT has proved completely reliable for detecting or ruling out the presence of a suprasellar mass, the direction and degree of parasellar extension, and the presence of any calcific or cystic component of the lesion. When multiple cut CT has been negative, further diagnostic studies have proved unrewarding. When CT has been positive, additional studies have been required in some cases to rule out aneurysm prior to craniotomy. (Author Abstract)

74. DIAGNOSIS OF EMPTY SELLA WITH CT SCAN.

Rozario R, Hammerschlag SB, Post KD, Wolpert SM, Jackson I

Dept. Neurosurgery, New England Medical Center Hosp., 171 Harrison Ave., Boston, MA 02111

Neuroradiology; 13(2):85-88 1977

The diagnosis of empty sella was made by computed tomography (CT) scanning. Two groups of patients were studied: 19 with empty sellas proven by pneumoencephalography (PEG) and 10 with pituitary tumors, determined clinically and by PEG. All patients with an empty sella proven by PEG were diagnosed correctly by CT. No patient with a normal CT or a CT suggestive of a pituitary tumor had an empty sella on PEG. Three false positives diagnosed on CT as possible empty sellas had normal PEG. All three were prolactin-hypersecreting tumors and at operation proved to have necrotic centers. The absorption values of the necrotic tumors were slightly lower than the av values for an empty sella. Furthermore, in all three false positives, the low values within the sella appeared to be focal, surrounded by the higher values of soft tissue. CT scanning is a very sensitive method for the diagnosis of the empty sella. Low absorption values within the sella may not be specific for an empty sella. The need for PEG can be questioned if CT evaluation fulfills the criteria for the diagnosis of an empty sella. A patient may have both an empty sella and a tumor. (32 Refs)

C. Other Lesions

75. BRAIN TUMORS STUDIED BY COMPUTERIZED TOMOGRAPHY.

Lin JP, Kricheff II, Laguna J, Naidich T

Neoplasia in the Central Nervous System; Thompson, R. A.; Green, J. R., eds. (New York: Raven Press): Advances in Neurology, vol. 15, pp. 175-199; 1976

Brain tumors are studied by computerized tomography (CT). A total of 2,500 patients was examined by CT at New York University Hospital from February 1974 to January 1975. Many patients were diagnosed as having either primary or secondary intracranial neoplasms. The diagnosis of intracranial neoplasm by CT was based on obliteration and deformity of subarachnoid spaces, displacement of calcified choroid plexus, the presence of edema, size of ventricles, displacement and deformity of ventricles, shift of midline structures, location and shape of the lesion, and/or changes of absorption coefficients. CT may be used as a screening tool with infrequent use of contrast enhancement. On the other hand, the use of contrast enhancement in the evaluation of patients with cerebral neoplasms adds another dimension to CT. It is concluded that CT has obtained a position as the most vital screening examination for patients suspected of cerebral atrophy, brain tumor, or hydrocephalus. (11 refs)

76. SPECTRUM OF MEDULLOBLASTOMAS DEMONSTRATED BY COMPUTED TOMOGRAPHY.

Zimmerman RA, Bilaniuk LT, Pahlajani H

Dept. Radiology, Hosp. Univ. Pennsylvania, 3400 Spruce St., Philadelphia, PA 19104

Radiology; 126(1):137-141 1978

Twenty-two patients with medulloblastomas were evaluated by computed tomography. Pretreatment evaluation in 13 patients has shown the various presentations of the tumor. Eighteen of the patients have had post-therapy computed tomographic studies. Computed tomography is sensitive in detecting residual and locally recurrent tumor as well as tumor seeding by cerebrospinal fluid pathways. Computed tomography has proved to be valuable in patient management and in evaluating the effectiveness of various forms of treatment. The present group of medulloblastomas is compared to other pediatric posterior fossa tumors and differential diagnoses are discussed. (Author abstract) (11 Refs)

77. THE RADIOLOGICAL DIAGNOSIS OF MENINGIOMAS, THE IMPACT OF EMI SCANNING.

Claveria LE, Sutton D, Tress BM

St. Mary's Hosp., Praed St., London, W. 2, England

Br J Radiol; 50(589):15-22 1977

Seventy-one intracranial and eight orbital meningiomas were examined by computerized axial tomography with the high-resolution matrix (160 x 160). Comparison with the results of plain x-ray examination, angiography, pneumography, and isotope scanning indicated that the new noninvasive method is undoubtedly the most accurate diagnostic tool yet available. It provided a specific diagnosis of meningioma in 77% of the intracranial cases without contrast enhancement and diagnosed the presence of tumor in a further 19% giving an overall tumour diagnosis of 96%. There were three false negatives (4%). After iv injection of contrast medium, specific diagnosis of meningioma was made in a further six cases, raising the specific diagnostic rate to 86%. Specific identification of intraorbital meningiomas was more difficult, though the presence of retro-orbital tumor was correctly diagnosed in all eight cases examined (100%). There was no false-positive diagnosis of a tumor. However, there are areas where a specific diagnosis of meningioma can be made only as part of a wider differential diagnosis. Apart from the orbit, these include the supraseller area, the cerebellopontine angle, and the intraventicular regions. Occasionally supratentiorial gliomas or secondaries can simulate meningiomas. (14 refs)

78. COMPUTED TOMOGRAPHY: THE ANATOMIC BASIS OF THE ZONE OF DIMINISHED DENSITY SURROUNDING MENINGIOMAS.

Sigel RM, Messina AV

Cornell Univ. Medical Center, 1300 York Ave., New York, NY 10021

Am J Roentgenol Radium Ther Nucl Med; 127(1):139-141 1976

The case history of a 60-yr-old woman with a small left posterior frontal parafalcine meningioma is presented. Computed tomography demonstrated a zone of diminished density around the meningioma which correlated in extent and position with widening of the subarachnoid space noted on pneumoencephalography and at surgery. This widening may be a simple mechanical effect or may be related to focal atrophy.

79. BILATERAL SUBFRONTAL GLIOMA SIMULATING A MENINGIOMA.

Gastaldo JA, Buchheit WA
Dept. Neurosurgery, Temple Univ. Hosp., 3401 North Broad St., Philadelphia, PA 19140
Surg Neurol; 7(2):105-106 1977

The case of a 66-yr-old woman with an intracranial glioma is presented. History, clinical signs, symptoms, location, and angiographic studies all suggested a benign, subfrontal lesion, probably a meningioma. The computerized axial tomogram showed a large bilateral subfrontal mass with a low-density center suggestive of cystic formation and, hence, of a glioma. Cystic changes within meningiomas do occur, but rarely. Malignant astrocytoma was found subsequently at surgery. Three similar cases of glioma simulating meningioma are included. (7 refs)

80. COMPUTED TOMOGRAPHY IN THE DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS OF GLIOBLASTOMAS: A QUALITATIVE STUDY OF 295 CASES.

Steinhoff H, Lanksch W, Kazner E, Grumme T, Meese W, Lange S, Aulich A, Schindler E, Wende S
Neuroradiologische Abteilung, Radiologischen Klinik im Klinikum Grosshadern, Marchioninistrasse 15, D-8000 Munchen 70, W. Germany
Neuroradiology; 14(4):193199 1977

An analysis of computed tomography (CT) findings in 295 patients with proven glioblastomas was conducted to determine to what extent a specific tumor diagnosis could be made by CT. Mixed absorption was the most frequent CT appearance (65%) with the plain scan of glioblastomas. On precontrast scans 44 glioblastomas (14.4%) were isodense compared to normal brain tissue. The location of the tumor could be determined in 32 of the isodense glioblastomas by indirect signs of a mass such as distortion of the normal brain structures and/or perifocal brain edema. Contrast enhancement was positive in 98% of the glioblastomas. The total detection rate of glioblastomas after contrast administration was 99.7%. A ring-shaped CT pattern of increased absorption was the most frequent (48.1% of the cases) CT finding after contrast enhancement of glioblastomas. A review of the initial CT diagnosis, based on the CT findings, the patient's history and the clinical data, revealed that the initial CT diagnosis was correct in 69.8% of the glioblastomas, with 41 recurrent glioblastomas included. (12 Refs)

81. COMPUTERIZED TOMOGRAPHY IN RELATION TO THE DIAGNOSIS OF GLIOMAS.

Huckman MS
no affiliation given
Recent Results Cancer Res; 51:79-87 1975

Known gliomas that occurred in 1,100 computerized axial transverse tomography scans (CT) are reported. There were 13 primary gliomas and 1 metastatic cerebral medulloblastoma which appeared 14 yr after surgery and radiation for a cerebellar medulloblastoma. Thirteen of the cases were surgically proved and 13 were recognized on CT scan as space-occupying lesions. Considering that a diagnosis on CT scan of glioma or metastases constituted a positive diagnosis, this was arrived at in 10 of 14 cases. One of 2 medulloblastomas presented as a false-negative CT scan because of an obscuring technical artifact. The 3 oligodendrogliomas in the series were all diagnosed incorrectly according to their histology, but each contained a good deal of calcification or hemorrhage which tended to obscure the underlying abnormality. All the Grade II and III astrocytomas (4) and glioblastomas multiforme (4) were correctly diagnosed. Thus, computerized axial transverse tomography appears to be a potentially useful agent in the diagnosis of gliomas as well as other intracranial masses.

82. COMPUTER TOMOGRAPHY OF CEREBELLOPONTINE ANGLE LESIONS.

Thomsen J, Gyldensted C, Lester J
Univ. ENT Dept. Rigshospitalet, 9 Blegdamsvej, DK 2100, Copenhagen, Denmark
Arch Otolaryngol; 103(2):65-69 1977

Computer tomography (CT) was used in 53 consecutive patients clinically suspected of having cerebellopontine angle tumors. Twelve patients had acoustic neuromas, 33 had normal meati, 1 had malignant melanoma, 1 anaplastic carcinoma, and 1 epidermoid carcinoma. Five case histories are presented. A 32-yr-old woman was diagnosed for a neuroma in the right cerebellopontine angle, a 41-yr-old man had a neuroma in the left cerebellopontine angle, and a 37-yr-old man was diagnosed for a large recurrent neuroma in the left fossa media and then a large cystic tumor in the left cerebral hemisphere. A 33-yr-old man had a transitional meningioma in the right angle. CT gave a false-positive diagnosis of a tumor in the left angle in a 58-yr-old man. CT should be included in the diagnostic tools for cerebellopontine angle tumors. (17 refs)

83. DIAGNOSIS OF EPIDERMOID TUMOR BY COMPUTED TOMOGRAPHY.

Avis KR, Roberson GH, Taveras JM, New PF, Trevor R
Departments of Radiology, Massachusetts General Hospital and Harvard Medical School, Boston, Mass
Radiology; 119(2):347-353 1976

Primary intracranial intradural extraventricular epidermoid tumor may be suggested by the findings on computed tomography (CT), which is also useful during the follow-up period. Epidermoid tumors may exhibit minimal symptoms and have usually spread far beyond their original site by the time they are found. Early detection, delineation, and characterization are possible with CT. (Author Abstract)

84. DENSE INTRACRANIAL EPIDERMOID TUMORS COMPUTED TOMOGRAPHIC OBSERVATIONS.

Braun IF, Naidich TP, Leeds NE, Koslow M, Zimmerman HM, Chase NE
Department of Radiology Albert Einstein College of Medicine, Bronx, N.Y.
Radiology; 122(3):717-719 1977

Epidermoid tumors may appear as sharply marginated, dense lesions measuring 80-120 Hounsfield units on noncontrast CT scans rather than as a homogeneously lucent lesions measuring -8 to +32 Hounsfield units previously described. The characteristic density range and the lack of contrast enhancement distinguish dense epidermoid tumors from other lesions. (Author Abstract)

85. DIAGNOSIS OF INTRATHALAMIC CYST BY COMPUTERIZED TOMOGRAPHIC SCAN.

Gregorius FK, Batzdorf U
UCLA Sch. Medicine, Los Angeles, CA 90024
Surg Neurol; 6(3):191-193 1976

The case history of a 38-yr-old man with an intrathalamic cyst is presented. The cyst had been diagnosed 5 yr previously as a thalamic glioma; it was not until a computerized tomographic (CT) scan was taken that the correct diagnosis was made. Drainage of the cyst was undertaken; within 2 wk there was a decrease in the patient's dysphasia. Six mo postoperatively, the hemiparesis had improved so that there was only mild weakness of the right lower face and upper extremity. His gait became more normal and spasticity of the right lower extremity was barely perceptible. A postoperative CT scan indicated that the cyst had collapsed.

86. CRANIAL CHORDOMAS.

Kendall BE, Lee BC

Natl. Hosp. for Nervous Diseases, London XCIN 3BG England

Br J Radiol; 50(598):687-698 1977

The clinical and radiological abnormalities in a series of 44 patients (28 men, 16 women; av 37.9 yr at onset) with cranial chordomas are presented. The clinical findings were most frequently accounted for by compression of the adjacent cranial nerves and brain stem or upper spinal cord. The predominant feature (95%) was well-defined bone erosion in the skull base. A soft tissue mass in the sphenoidal sinus or nasopharynx (43%) and calcification of the tumor (34%) were also noted. Computed transmission tomography was abnormal in all cases and may replace invasive studies in many cases. The subarachnoidal space is usually patent and the dura undisplaced, which may help to distinguish between chordomas and other tumors. Carotid angiography gave accurate results in 72% of the cases. Some marked vascularity of the tumors was noted. (50 Refs)

87. CAVERNOUS HAEMANGIOMA IN THE PINEAL REGION.

Hubschmann O, Kasoff S, Doniger D, Llena J, Leeds N

Neurosurgical Section, Veterans Admin. Hosp., East Orange, NJ 07018

Surg Neurol; 6(6):349-351 1976

The case history of a 45-yr-old man with a cavernous hemangioma in the pineal region is presented. He presented with difficulty in maintaining his equilibrium of 6 mo duration. Computerized tomography demonstrated a mass in the pineal region; further studies indicated a benign tumor in this region. Total removal of the tumor was achieved using the supracerebellar, infratentorial approach. The postoperative course was uneventful. When seen 8 mo later, his neurological examination was normal except for limitation in his upward gaze. A histological description of the hemangioma is presented. (5 refs)

88. COMPUTERIZED TOMOGRAPHY IN THE EVALUATION OF PITUITARY ADENOMAS.

Citrin CM, Davis DO

George Washington Univ Med Center, Dept of Radiology, 901 23rd Street, N.W., Washington D. C. 20037

Invest Radiol; 12(1):27-35 1977

Computerized tomography during the past few years has unequivocally been proven to be of extreme value in the evaluation of intracranial disease. Despite earlier reports, accuracy of diagnosis in the area of the sella turcica is found to be high despite the close proximity of both bony and air-containing structures. Correlation between computed tomographic images, angiography and pneumoencephalography has been performed and demonstrates that CT scans with a low margin of error depict the relationships of pituitary adenomas to the surrounding brain parenchyma. The continued importance of angiography, and to some degree pneumoencephalography, in the diagnosis of pituitary tumors is discussed. (4 Refs) (Author Abstract)

89. CRANIOPHARYNGIOMA: BASED ON 160 CASES.

Banna M

McMaster Univ. Medical Centre, 1200 Main St. West, Hamilton, Ontario, Canada L8S 4J9

Br J Radiol; 49(579):206-233 1976

Various aspects of craniopharyngioma, as taken both from literature and 160 cases, are reviewed. These aspects are: the history and etiology of the tumor; the incidence, age and sex; the pathology; the clinical and radiological manifestations; and the results of angiography, air study, cystography, isotope scintigraphy, and computerized tomography.

90. COMPUTED TOMOGRAPHY IN METASTATIC DISEASE OF THE BRAIN.

Deck MD, Messina AV, Sackett JF

Department of Radiology, Section of Neuroradiology, New York Hospital-Cornell Medical Center, New York, New York

Radiology; 119(1):115-120 1976

Computed tomography has been found to be a more accurate diagnostic tool in the analysis of brain metastases than radionuclide scanning. Of 1,100 patients studied by CT scan, 57 showed evidence of intracerebral metastasis, and 14 showed evidence of hydrocephalus. Density levels below that of normal brain tissue were found in cases of metastases from the lung (13), breast (7), melanoma (4), kidney (3), lymphoma (3), and nasopharynx (1); levels above normal were found in cases of metastases from melanoma (8), lung (3), colon (3), chorionic carcinoma (2), osteogenic sarcoma (1), and kidney (1).

91. INTRACEREBRAL METASTATIC MELANOMA: CT EVALUATION.

Solis OJ, Davis KR, Adair LB, Roberson GR, Kleinman G

Dept. Radiology, Neuroradiology Section, Massachusetts General Hosp., Boston, MA 02114

Comput Tomography; 1(2):135-143 1977

Details of computer tomographic (CT) scan examinations of 14 patients (10 men, 28-65 yr; 4 women, 37-63 yr) with metastatic intracerebral melanoma are presented. All patients had a history of excision of a skin lesion. All the cases were abnormal on either plain or contrast-enhanced CT. The av time from onset of neurological deficit to CT scan diagnosis was 14 days. The av time from the pathologic diagnosis of the primary to the demonstration of the metastatic focus in the brain by CT scan was approx 3.5 yr. In six cases there was pathologic proof of the brain metastasis; one case showed abnormal cerebrospinal fluid. The CT scan of all 14 cases showed high absorption abnormality with hemorrhage range density values; 6 showed multiple lesions. Edema surrounded all of the lesions. Twelve cases showed mass effect with compression of the lateral ventricle. Obstructive hydrocephalus secondary to obstruction of the fourth ventricle by a metastasis was seen in two cases. (13 Refs)

92. DIAGNOSIS OF PROGRESSIVE MULTIFOCAL LEUKOENCEPHALOPATHY BY COMPUTED TOMOGRAPHY.

Carroll BA, Lane B, Norman D, Enzmann D

Division of Diagnostic Radiology Department of Radiology, Stanford University School of Medicine, Stanford, Calif.,

Radiology; 122(1):137-141 1977

Progressive multifocal leukoencephalopathy (PML) is a demyelinating disease of the central nervous system which predominantly affects immunologically compromised hosts. The distinctive CT appearance in three documented cases includes low-density lesions of central and convolutional white matter with scalloped lateral borders. Lesions demonstrate no mass effect or contrast material enhancement. Findings are discussed with reference to other entities which may produce a similar CT appearance. (Author Abstract)

93. ACUTE LYMPHOBLASTIC LEUKEMIA WITH CEREBRAL LESIONS DISCOVERED BY COMPUTERIZED AXIAL TRANSVERSAL TOMOGRAPHY.

Gastaut JA, Gastaut JL
Clinique des Maladies du sang, Hopital de la Conception, 136, rue St. Pierre, 13385 Marseille Cedex 4, France
Nouv Rev Fr Hematol ; 15(5):517-526 1975

A 6-yr-old girl with acute lymphoblastic leukemia, (ALL) who was treated with vincristine(1.5 mg/m /wk) and prednisone (40 mg/m² /day) and maintained with methotrexate (12 mg 2x/wk im), developed leukemic meningitis and a Lennox-Gastaut syndrome. A computerized transverse axial tomography revealed abnormal intracerebral lesions: atrophy of the left hemisphere corresponding to EEG detected anomalies and right frontal lesions undetected by EEG (no localized pain) and radiographies. There were no lymphoblasts in the cerebrospinal fluid. The lesions were probably due to lymphoblastic infiltration. The coexistence of intraparenchymatous leukemic infiltrates and normal cerebrospinal fluid is not paradoxic since the patient never underwent irradiation of the central nervous system. Transverse axial tomography should complement lumbar puncture in the monitoring of neurologic complications of acute leukemia. (19 refs)

V. ORBITAL LESIONS

94. A COMBINED APPROACH FOR THE DIAGNOSIS OF ORBITAL DISEASE. COMPUTED TOMOGRAPHY AND STANDARDIZED A-SCAN ECHOGRAPHY.

Hodes BL, Weinberg P
Dept. Ophthalmology, Northwestern Univ. Medical Sch., 303 East Chicago Ave., Chicago, IL 60611
Arch Ophthalmol; 95(5):781-788 1977

Twenty patients with orbital disease were assessed by standardized A-scan echography (ultrasonography) and computed tomography (CT scan). A-scan echography alone was capable of identifying the presence of tumor masses in almost all instances, with small lesions (less than 5 mm) at the orbital apex being the most difficult to differentiate. All 11 of the tumor masses were demonstrated and accurately localized, although extension beyond the bony orbit at the apex was not possible in 1/2 tumors with CT-proved intracranial extension. However, in 9/11 tumors, sufficient tissue texture information was obtained to permit an attempt at histologic characterization preoperatively. The CT scan was abnormal in 15 cases, a large wooden foreign body was identified, 11/11 tumors were identified, and nonspecific abnormal radiodensities were demonstrated in 3 additional cases. The overall diagnostic capability was 19/20, with a tissue diagnosis achieved on echographic bases in 17/20. The combined echographic and radiologic approach to orbital abnormalities is essential to the proper evaluation of orbital disease. (13 Refs)

95. COMPUTERIZED TOMOGRAPHY OF THE ORBIT USING THIN SECTIONS.

Hilal SK, Trokel SL
Neurological Inst., 710 West 168th St., New York, NY 10032
Semin Roentgenol; 12(2):137-147 1977

Computerized tomography (CT) has contributed greatly to the diagnosis and management of orbital diseases, particularly lesions of the retrobulbar space. Max resolution is obtained through the use of six to eight tomographic sections, each 4 mm thick, and when the plane of the scan intersects the canthomeatal line at a 10 angle. This plane permits the imaging of the two optic nerves in their entire course from the globe to the orbital apex. In a series of 213 retrobullar space masses, CT scans resulted in only one faise negative. Conditions detected and characterized included dacryocystitis, granulomatous disease, Graves disease, benign vascular lesions, extra- and intraconal orbital neoplasms, and ocular lesions. Although the sensitivity of CT is generally greater for intraorbital lesions than for intraocular lesions, the technique is important in the diagnosis of intraocular foreign bodies of low density and is indispensable for the study of retinoblastoma. (20 Refs)

96. LATERAL MICROSURGICAL APPROACH TO INTRAORBITAL TUMORS.

Maroon JC, Kennerdell JS
Univ. Pittsburgh Sch. Medicine, Pittsburgh, PA 15261
J Neurosurg; 44(5):556-561 1976

A microsurgical lateral orbital approach to intraorbital tumors is described. In seven patients, ultrasonic scanning, computerized axial tomography, polytomography, orbital venography, and arteriography allowed precise intraorbital tumor localization relative to the optic nerve for a preoperative evaluation. The results indicate that circumscribed tumors superior, lateral, or inferior to the optic nerve can be safely and completely removed through a 30-35-mm lateral skin incision with microsurgical dissecting techniques. A combined neurosurgical-ophthalmological team approach is recommended.

97. ORBITAL TERATOMA IN THE NEWBORN. A CASE REPORT.

Hann LE, Borden S, Weber AL
Depts. Radiology, Massachusetts General Hosp., Massachusetts Eye and Ear Infirmary, Boston, MA 02114
Pediatr Radiol; 5(3):172-174 1977

A case of congenital orbital teratoma in a newborn boy is reported. The patient had severe proptosis of the right eye, with the globe extending beyond the orbital confines. Movements of the eye were limited but preserved in all directions. Plain radiographs confirmed increased soft tissue density, generalized symmetrical enlargement of the right orbit, a normal optic foramen, and a normal superior orbital fissure. Irregular curvilinear calcification or ossification was demonstrated in the retrobulbar region. Computerized tomography revealed a large retrobulbar mass without intracranial extension displacing the globe anteriorly. There was no enhancement following the administration of contrast material. The mass was characterized as multicystic on ultrasound examination. The entire tumor was surgically excised, with preservation of the globe and optic nerve. The degree of vision on the operated side was promising. The pathologic findings were characteristic of a benign teratoma. The patient is one of a small number in whom vision was preserved postoperatively. (3 refs)

98. GIANT DRUSEN (ASTROCYTIC HAMARTOMA) OF THE OPTIC NERVE SEEN WITH COMPUTERIZED AXIAL TOMOGRAPHY.

Daily MJ, Smith JL, Dickens W
Bascom Palmer Eye Inst., Miami, Fla.
Am J Ophthalmol; 81(1):100-101 1976

An EMI scan (computerized axial tomography) performed on a 75-yr-old man with giant drusen (astrocytic hamartoma) of the left optic nerve clearly revealed a dense localized mass at the distal termination of the left optic nerve. The EMI scan proved to be an accurate, noninvasive technique for neuro-ophthalmologic diagnosis in this case.

99. INTRACANALICULAR MENINGIOMA WITH NORMAL TOMOGRAPHY.

Susac JO, Martins AN, Whaley RA

Dept of Neuroophthalmology, Walter Reed Army Med Center, Washington, DC.

J Neurosurg; 46(5):659-662 1977

A middle-aged woman presented with the typical symptoms and signs of a compressive optic nerve lesion. Plain skull films, tomography of the optic canals, and selective angiography with magnification and subtraction were normal. Computerized transaxial tomography clea.ly showed the tumor, which was a meningioma of the optic nerve sheath. At surgery the tumor was found within the optic canal with intracranial and orbital extensions. It was strictly intradural and did not involve the surrounding bone at any point. This case documents the fact that an intracanalicular meningioma may be associated with normal tomograms of the optic canal. (3 Refs). (Author Abstract)

100. COMPUTERIZED AXIAL TOMOGRAPHY IN PATIENTS WITH EXOPHTHALMOS (LETTER TO EDITOR).

Trokel SL, Hilal SK

New York

Arch Ophthalmol; 94(5):867-868 1976

Swollen extraocular muscles associated with Graves disease or orbital myositis present an appearance that may be confused with an orbital tumor when viewed in tomographic section. An orbit tumor can be distinguished from a swollen muscle in that the swollen inferior or superior rectus muscle edge has a feathered appearance while the orbit tumor has a sharp edge. Swollen extraocular muscle is unusual in Graves disease.

VI. HEAD AND NECK LESIONS

101. HEAD AND NECK. (PP. 84-109)

Scanlan RL

Diagnosis and Staging of Cancer A Radiologic Approach. Steckel RJ, Kagan AR, ed. Philadelphia WB Saunders Company, 1976.

A radiologic approach to the diagnosis of cancer of the head and neck is described. Patients with primary head and neck lesions that are undifferentiated or large, as well as those with localized or regional lymphomas and fixed cervical nodes, should be considered for at least part of a therapeutic program. However, patients with very large lesions, or those with head and neck cancers causing invasion of bone or functional impairment, are not candidates for irradiation alone. Computerized tomography has revolutionized the radiology of the brain and orbit. Because of the low fat density of the orbital contents, the bulb of the eye and lens, as well as the optic nerve, can be easily demonstrated; the ocular musculature is also often seen. Intraorbital extension of an intracranial tumor, or intracranial extension of an orbital tumor, is frequently demonstrable by computerized tomography. (111 refs)

102. COMPUTERIZED TOMOGRAPHY (CT) IN OTOLARYNGOLOGY.

Wortzman G, Holgate RC

Dept. Neuroradiology, Toronto General Hosp., Toronto, Ontario, Canada

Laryngoscope; 86(10):1552-1562 1976

Computerized tomography (CT) scanning in otolaryngology is discussed. Its main impact in this field has been largely in four areas: first, in either acquired or congenital facial deformities such as hypertelorism, fibrous dysplasia, ossifying fibroma and Crouzon's disease; second, in primary or secondary tumors of the sinuses; third, in cerebello-pontine angle lesions as meningiomas, acoustic neuromas, and glomus jugulare tumors in which CT visualizes the larger acoustic neuroma and so renders contrast myelography unnecessary; and fourth, in infections such as cerebral abscess or cerebritis secondary to sinus or mastoid disease. In CT scanning, subtle differences in position and an increase in density before contrast enhancement allow a differentiation of angle meningiomas from acoustic neuromas. In addition, CT scanning has a very important role in the postoperative assessment of angle tumors. Future changes will allow much finer detail, re-orientation of the horizontal information into any plane, and much more accurate differentiation of tissue density. The principle of CT image reconstruction is being applied to both isotope and ultrasound scanning and should improve their accuracy and yield. (6 refs)

103. NECK AND MEDIASTINAL ANGIOGRAPHY BY COMPUTED TOMOGRAPHY SCAN.

Carter BL, Ignatow SB

Department of Radiology, Tufts-New England Medical Center, 171 Harrison Avenue, Boston, Mass. 02111.

Radiology; 122(2):515-516 1977

CT scanning of the neck and upper mediastinum is a valuable tool in the differential diagnosis of soft-tissue tumors. Visualization of the major vessels in the neck, which aids in the study, can be accomplished by a rapid intravenous drip infusion technique during the actual scanning, a new approach to contrast enhancement. (Author Abstract)

104. THE IMPORTANCE OF CT FOR THE TNM CLASSIFICATION OF TUMORS INVOLVING THE PARANASAL SINUSES, THE NASOPHARYNX, AND THE PAROTID GLANDS.

Lohkamp F, Claussen C

Institut fur Nuklearmedizin, Deutsches Krebsforschungszentrum, 6900 Heidelberg, W. Germany

Laryngol Rhinol Otol; 56(9):740-748 1977

Modifications of the computer tomographic soft part diagnosis in the TNM classification of malignancies of the oro-nasopharynx, the paranasal sinuses, and the parotid gland are discussed. The subdivisions of the deep inaccessible regions of the facial skull such as the retromaxillary space and its soft tissue thus become visible. Computer tomography is essential for cases of intraorbital or intracranial tumor spread. In the oro and nasopharynx, computer tomography with help from transversal and frontal sections allows for a more effective differentiation of tumor dissemination in the T3/T4 stages. In the diagnosis of the parotid gland tumors computer tomography allows for the assessment of deep glandular tumors and tumor extension into the parapharyngeal space. (18 Refs)

105. LIMITATIONS OF COMPUTED TOMOGRAPHY IN THE INVESTIGATION OF ACOUSTIC NEUROMAS.

Parker SW, Davis KR

Dept. Otolaryngology, Massachusetts Eye and Ear Infirmary, Boston, MA

Ann Otol Rhinol Laryngol; 86(4,pt1):436-440 1977

Seventy percent of 80 surgically proven acoustic neuromas were visualized on preoperative computed tomography (CT) scans. Many more tumors were seen on contrast enhanced scans than on unenhanced scans (55 vs 25). No intracanalicular tumors and only 1 of 15 tumors less than 2 cm in size were visualized on CT scan. Most medium size tumors (2.0-3.0 cm) and all large tumors (greater than 3.0 cm) were visualized on CT scan when optimal technique was used. Positive CT scans often replace more invasive diagnostic studies in the investigation of acoustic neuromas. Negative scans do not rule out tumors as intracanalicular, and small tumors are usually not visualized with current techniques. If there is clinical suspicion of an acoustic neuroma, positive

contrast posterior fossa cisternography should be done when the CT scan is negative. (Author abstract) (6 Refs)

106. AN EVALUATION OF CURRENT DIAGNOSTIC RADIOLOGIC MODALITIES IN THE INVESTIGATION OF ACOUSTIC NEURILEMMOMAS.

Dubois PJ, Drayer BP, Bank WO, Deeb ZL, Rosenbaum AE

Dept. Radiology, Univ. Pittsburgh Health Center, Presbyterian-Univ. Hosp., Pittsburgh, PA 15216

Radiology; 126(1):173-179 1978

The radiologic investigation of patients with suspected acoustic neurilemmomas may include specialized plain films, thin-section tomography, computed tomography (CT) scanning with iv contrast enhancement; Pantopaque cisternography, radionuclide scanning, angiography, and pneumoencephalography. Recently we have used intrathecally enhanced (Amipaque) CT cisternography to study the cerebellopontine angles and fourth ventricle. An assessment is made of the differential diagnostic value and limitations of radiologic modalities both in tumor detection and in accurate localization. A protocol designed to optimize use of the available radiologic modalities is projected from 30 patients with acoustic neurilemmomas. (Author abstract) (17 Refs)

107. FACIAL BONE SCANNING BY EMISSION TOMOGRAPHY.

Brown ML, Keyes JW, Leonard PF, Thrall JH, Kircos LT

Mayo Clinic, Rochester, MN 55501

J Nucl Med; 18(12):1184-1188 1977

A single-photon emission tomographic system was used to study the normal anatomy of the facial bones and the usefulness of emission computed tomography in evaluating diseases of the bones of the face. The examination was performed following routine bone scintigraphy and took an additional 20-30 min. The anatomy of the facial bones was well defined, with clear separation of deep and superficial structures. Early experience with tumor, infection, bone grafts, and postirradiation osteonecrosis indicates that useful added diagnostic information can be obtained by this method. (Author abstract) (11 Refs)

108. CT STUDIES OF TUMORS OF THE SKULL BASE AND FACE (MEETING ABSTRACT). (PP. 5)

Caille JM, Constant PH, Renaud-Salis JL

Centre Hospitalier de Bordeaux, Bordeaux, France

Whole Body Non-Neurological C T Studies Computerized Tomography Seminar Held in Washington, DC, 16 April 1977 Computerized Tomography Society, Washington, DC, 1977.

We examined 40 patients with past or present tumors of the skull base or face. Excluded from this study were intracranial and extracranial tumors near the base or invading the base, as well as tumors with an intraorbital starting point. Out of the 40 patients, 15 were examined before and after an injection of iodinate contrast medium, 4 were examined before and after radiotherapy, and 4 were examined for the first time only after radiotherapy. The mean density level of most of the tumors was compared with that of the external pyterygoid muscle before and after injection of contrast agent before and after radiotherapy. Because of considerable im diffusion, iodinate contrast medium was not effective in the diagnosis of these tumors. The advantages of computed tomography (CT) scanning were incontestable in determining the tumoral vol before surgery or radiotherapy and in diagnosing tumors of the nasopharynx. Five patients at clinical examination presented apparently primary cervical adenopathies, while in four cases conventional radiology and cavoscopy were normal. CT showed the deformations of the nasopharynx and tumor hyperdensity. Biopsies using CT allowed precise histological diagnosis. (no Refs)

VII. GENERAL APPLICATIONS OF BODY SCANNING

A. Thorax, Abdominal, and Spinal Scanning

109. COMPUTED TOMOGRAPHY OF THE BODY. A NEW HORIZON.

Alfidi RJ, Haaga JR

Cleveland Clinic Center, 9500 Euclid Ave., Cleveland, OH 44106

Postgrad Med; 60(2):133-136 1976

Computed tomography (CT) has advanced considerably since the first type of scanner was developed. Scanners presently in use minimize the effects of respiration and those soon to be developed will eliminate the problems associated with cardiac movement. Although CT has been used primarily in the study of the CNS, studies have indicated that it can be used in the study of the lungs, heart, mediastinum, subdiaphragmatic space, liver, bile ducts, pancreas, kidneys, ureters, bladder, bony abnormalities and the breast. CT also enables the taking of biopsy material with a high degree of accuracy for the target area. Studies are currently underway to determine its total effectiveness.

110. INITIAL CLINICAL EXPERIENCE WITH COMPUTERIZED TOMOGRAPHY OF THE BODY.

Stephens DH, Sheedy PF, Hattery RR, Hartman GW

Mayo Clinic, Rochester, MN

Radiol Clin North Am; 14(1):149-158 1976

Experience with computerized tomography of the body using an instrument capable of completing a scan within a period brief enough to allow the patient to suspend respiration is reported. The production of a cross-section tomographic reconstruction involves the passage through the patient of a highly collimated fan-shaped x-ray beam from a single x-ray tube to an array of crystal detectors. The tube and detectors are mounted opposite each other on a frame that rotates around the patient. The full scan involves a rotation of 180 degrees and is completed in 20 sec to produce a single tomographic slice representing 13 mm tissue thickness. A slower scanning time of 85 sec is available for examining parts of the body in which respiratory motion is not of consequence. The data accumulated during each scan are processed by computer. In the initial clinical investigations, emphasis has been on detection of neoplasms. Tumors have been detected in the head and neck, the thorax, liver, pancreas, kidney, and pelvis. In some cases, contrast material was administered iv. Accurate assessment was made of the location and extent of soft tissue tumors in the extremities and, in the presence of liposarcoma, accurate diagnosis was made because of the low density of the lesion and its invasive nature. It is suggested that studies be undertaken to evaluate the efficacy of computerized tomography as a diagnostic tool compared to other methods.

111. THE WHOLE BODY SCAN. COMPUTED TOMOGRAPHY (CT) - A MAJOR ADVANCE IN THE DIAGNOSIS OF CANCER.

Watson RC

Dept. Diagnostic Radiology, Memorial Sloan Kettering Inst., New York, NY

Clin Bull; 6(2):47-51 1976

The usefulness of whole body computed tomography (CT) scans in diagnosing cancer is evaluated. The scanning time can be as short as 20 sec. A 2 min scan reveals exquisite detail. Helpful results have been attained in areas of the neck,

nasopharynx, retroorbital tumors, some intraocular lesions, the mediastinum (more in localizing masses than in differentiating and separating normal vascular structures), lung metastases, determining the relation of tumors to the heart and pericardium, bladder tumors, pancreatic tumors (although it is not always possible to differentiate carcinomas from pancreatitis), liver metastases (of 2 cm or more in diameter), and metastatic involvement from bone tumors. The definition of bilobar involvement in possible candidates for radical lobectomy has been of vital importance. Dilatation of the ductal system within the liver offered some success, but it is doubted that CT will detect early dilatation or replace cholangiography in determining site and cause of biliary obstruction. The kidney is well evaluated, even the non-functioning kidney in the anuric patient. CT cannot replace conventional tomography in diagnosing early bone erosion, nor in differentiating calcified benign lesions from malignant tumors. Examinations of the heart (except in demonstrating pericardial effusions), and diagnosing subhepatic or diaphragmatic abscesses have not been advanced by CT. CT has been of particular importance in planning treatment prior to radiation therapy and in evaluating effects of chemotherapy and radiation therapy. CT has caused a significant diminution in the demand for carotid arteriography, pneumoencephalography, and urine roentgenographic examinations of the skull. (no refs)

112. COMPUTED TOMOGRAPHY OF THE THORAX.

Jost RG, Sagel SS, Stanley RJ, Levitt RG
Mallinckrodt Inst. Radiology, Washington Univ. Sch. Medicine, 510 S. Kingshighway, St. Louis, MO 63110
Radiology; 126(1):125-136 1978

Computed tomography (CT) provided a valuable new perspective in assessing abnormalities of the thorax. Over a 15-mo period, 144 patients with problems involving the thorax were studied using CT. In the patient with a mediastinal mass or widening detected by plain chest radiography, a definitive diagnosis was sometimes possible which would not be obtainable by conventional noninvasive radiologic l techniques. In certain clinical situations, CT was a highly sensitive modality for examining the lungs. The proved and potential clinical uses of CT in solving diagnostic problems of the thorax are discussed. (10 Refs)

113. DETECTION OF PULMONARY NODULES BY COMPUTED TOMOGRAPHY.

Muhm JR, Brown LR, Crowe JK
Mayo Clinic and Mayo Foundation, Rochester, MN 55901
Am J Roentgenol Radium Ther Nucl Med; 128(2):267-270 1977

Pulmonary nodules undetected by conventional chest radiography and whole lung tomography were found in 11 of 23 patients when they were examined by computed tomography (CT). Seventeen of the patients were known to have single or multiple pulmonary nodules. Three of these were being examined for possible metastasis, two because of positive sputum cytologies and one for a right paratracheal adenotrophy. Scans of the chest were taken from the apex to the posterior costophrenic angle at 1.5 cm intervals using a prototype EMI body scanner. In 9 cases, CT was consistant with chest films and whole lung tomography; in 11 cases, additional nodules were detected; and in 3 cases, CT showed fewer nodules. The study indicates that pulmonary nodules not detected by conventional means may be found using CT. (9 refs)

114. PRELIMINARY EVALUATION OF THE E.M.I. WHOLE BODY SCANNER.

Kreel L
Dept. Radiology, Clinical Res. Centre and Northwick Park Hosp., Watford Road, Harrow, Middlesex HA1 3UJ, England
J Belge Radiol; 59(3):267-280 1976

The first thoracic image obtained in vivo by computerized axial tomography is presented. The utilization of the whole body scanner applies to the abdomen, skull, and thorax. Following removal of the water bag, the base of the skull can be examined, and axial anatomical sections can be obtained at various levels of the abdomen and thorax. The superiority of this technique over the usual radiological methods is apparent in the study of adenopathological conditions of the retrosternal space and the mediastinum, the early detection of a pleural effusion, and the demonstration of patches of asbestosis on the pleura. The most spectacular field of application is associated with the retroperitoneal cavity, where the technique is better than lymphography for studying adenopathological conditions. This method can also be used to investigate the great abdominal and thoracic vessels. (no refs)

115. COMPUTED TOMOGRAPHY OF THE THORAX AND ABDOMEN; A PRELIMINARY REPORT.

Alfidi RJ, Haaga J, Meaney TF, Macknyre WJ, Gonzalez L, Tarar R, Zelch MG, Boller M, Cook SA, Jelden G
Departments of Radiology and Radiation Therapy and Nuclear Medicine, Cleveland Clinic Foundation, Cleveland, Ohio
Radiology; 117(2):257-264 1975

The utility of computed tomography (CT) in the study of the anatomy, physiology, and pathology of the human body has been the subject of considerable interest since the introduction of CT scanning. The advent of a new prototype scanning device has made it possible to examine a variety of abnormalities in the abdomen and thorax in a manner not previously possible. This development permits a remarkable insight into the study of human disease in vivo. (Author Abstract)

116. COMPUTED TOMOGRAPHY OF THE ABDOMEN.

Stephens DH, Hattery RR, Sheedy PF
Mayo Clinic, Rochester, Minn
Radiology; 119(2):331-335 1976

Normal and pathological anatomy of the abdomen is accurately displayed by computed tomography using the first system capable of completing a scan within a time brief enough to allow the patient to suspend respiration. (Author Abstract)

117. COMPUTERIZED AXIAL TOMOGRAPHY IN THE DIAGNOSIS AND DETECTION OF TUMORS OF THE PELVIC AND LOWER ABDOMINAL REGIONS.

Osteaux M, Struyven J, Huvenne J, Jeanmart L
Service de Radiodiagnostic, Institut Bordet, rue Heger-Bordet, 1, 1000 Brussels, Belgium
J Belge Radiol; 59(3):293-300 1976

Computerized axial tomography of the pelvic and lower abdominal regions revealed that 6/10 patients were positive (retroperitoneal lymphomatous infiltration, rhabdomyosarcoma of the ischiorectal fossa, uterine fibromyomatosis, relapse of a retroperitoneal liposarcoma, two ovarian tumors) and four negative. It was impossible to follow-up three of these. The method cannot distinguish between a solid benign tumor and a malignant tumor; however it can determine the topography of a tumor as well as its

interaction with neighboring organs. Its representation of musculature is far superior to that of other methods. (3 refs)

118. COMPUTED TOMOGRAPHY: A VALUABLE AID TO THE ABDOMINAL SURGEON.

Cooperman AM, Haaga J, Alfidi R, Steiger E, Hermann R
Department of General Surgery, the Cleveland Clinic Foundation; 9500 Euclid Avenue, Cleveland, Ohio 44106.
Am J Surg; 133(1):121-126 1977

The application of computed tomography (CT) for diseases of the liver, pancreas, kidney, and retroperitoneum has been described. The diagnostic accuracy of CT when compared with angiography, radioisotope scanning, endoscopic pancreatography, and transhepatic cholangiography is now being studied prospectively. The attractive features of CT include low risk, wide applicability, noninvasive technics, high diagnostic accuracy, and patient acceptance. (Author Abstract)

119. WHOLE-BODY COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF ABDOMINAL AND THORACIC MALIGNANCY: REVIEW OF 600 CASES.

Schaner EG, Head GL, Kalman MA, Dunnick NR, Doppman JL
Diagnostic Radiology Dept., Clinical Center, Building 10, Room 6S211, NIH, Bethesda, MD 20014
Cancer Treat Rep; 61(8):1537-1560 1977

Whole-body computed tomography (CT) was performed on 600 patients, most of whom had known or suspected intra-abdominal or intrathoracic malignancy. CT was more accurate than lymphangiography in defining retroperitoneal pathology, especially diffuse and extensive lymph node invasion in patients with lymphoma and metastatic testicular carcinoma. Distinguishing medical from surgical jaundice was possible with CT, as was identification of deep-seated intrahepatic metastases. CT was valuable in documenting pancreatic tumor growth during therapy. Adrenal lesions were well defined using CT, without the morbidity associated with angiography. Renal abnormalities were visualized so well that it was thought that CT could possibly replace other diagnostic procedures for these conditions. CT was a useful adjunct in evaluating tumors of ovarian and uterine origin. CT may also have a limited but specific use in defining pleural and chest wall metastases and neoplasms. (22 Refs)

120. PHYSICAL METHODS OF TUMOUR LOCALIZATION. COMPUTERIZED TOMOGRAPHY IN THE LOCALIZATION OF ABDOMINAL MALIGNANCY.

Husband JE, Kreel L
Dept. Diagnostic Radiology, The Royal Marsden Hosp., Downs Road, Sutton, Surrey SM2 5PT, England
J R Soc Med; 71(1):35-38 1978

The use of computed tomography (CT) in the localization of abdominal malignancies is discussed. Tumors of the pancreas can be visualized by CT if they produce an abnormality in the contour of the gland. Small entirely intrapancreatic tumors cannot be visualized with CT at the present time. Non-opacified lymph nodes associated with testicular tumors can be seen with CT if they are enlarged. Lymphographic findings were compared with CT scan results in 11 patients with testicular tumors. Non-opacified lymph nodes above the second lumbar vertebra were detected in all patients with positive lymphograms, and in one patient each with a negative and equivocal lymphogram. In two patients abnormal nodes were demonstrated beneath the crura of the diaphragm up to the level of the tenth thoracic vertebra. Non-opacified lymph nodes were also demonstrated in the splenic and hepatic hila in two patients. Small sclerotic lesions identified as metastases at autopsy were identified by CT scans in six patients. Metastases were also demonstrated in the lungs of two patients. CT scans were recommended for the localization and determination of the extent of tumors of the abdomen.

121. COMPUTED TOMOGRAPHY OF THE ABDOMEN IN THE MALIGNANT LYMPHOMAS.

Harell GS, Breiman RS, Glatstein EJ, Marshall WH, Castellino RA
Dept. Radiology S052, Stanford Univ. Medical Center, Stanford, CA, 94305
Radiol Clin North Am; 15(3):391-400 1977

Computed tomography (CT) is useful in the diagnosis of para-aortic lymph node involvement in patients with malignant lymphoma of the abdomen. CT is more accurate than lymphography in estimating involvement when nodes are enlarged. CT is noninvasive and requires little skill to perform. In patients with undocumented lymphoma, CT scanning will yield a high rate of diagnostic accuracy. Better spatial resolution of lymphograms allows nodal morphology to be assessed. Since CT detection of lymph node disease is now dependent on size, some involvement may be missed. CT is more accurate for palpable mesenteric lymphomatous masses than clinical palpation, and may detect enlargement when other tests are normal. Normal size nodes are not detectable with CT now. CT provides a good indication of splenic wt. Splenic involvement can be determined if CT can detect the parenchymal nodules of lymphoma, but right now this accuracy of CT is not well documented. CT detection of liver involvement is difficult, but it can detect biliary obstruction caused by lymphoma and direct extension into the liver by lymphomatous masses. CT may be a sensitive indicator of osseous involvement. The use of CT in detecting abdominal lymphomas is compared with other diagnostic methods. (22 Refs)

122. COMPUTED TOMOGRAPHY OF THE PELVIS.

Redman HC
Dept. Radiology, Mount Zion Hosp. and Medical Center, P. O. Box 7921, San Francisco, CA, 94120
Radiol Clin North Am; 15(3):441-448 1977

The use of computed tomography (CT) in the evaluation of pelvic disorders is discussed. CT is useful in evaluating the pelvic sidewalls and the pelvis of the patient whose urinary bladder cannot be distended enough to allow adequate ultrasound transmission. CT is also useful in diagnosing bladder diseases and in the staging of bladder tumors. In addition CT shows neoplastic spread beyond the bladder wall and can determine the position of the ureters in relation to a pelvic mass. The prostate can be visualized by scans done 2-3 cm cephalad to the symphysis pubis. The primary diagnostic modality for the visualization of the pelvis is ultrasound, however, only CT can provide information regarding the early side spread of a pelvic neoplasm. (6 Refs)

123. COMPUTED TOMOGRAPHY (C.T.) IN AFFECTIONS OF THE VERTEBRAL COLUMN AND OF THE SPINAL CORD.

Palmers Y, Baert AL, Marchal G, Coenen Y
Dept. Radiodiagnostic, Univ. Leuven, Leuven, Belgium
J Belge Radiol; 59(6):521-530 1977

The use of computer tomography (CT) in the diagnosis of diseases of the spinal cord is presented. Conditions that can be visualized with CT include bone changes in the vertebral column, for example, osteoporosis, arthrosis, congenital malformations, and metastasis; and pathologic lesions in the spinal canal, such as diastematomyelia, angiomatous lesions, extrinsic and intrinsic tumors, and intra-medullary cysts. Degenerative changes of the vertebral bones and osteoporosis can be better demonstrated with conventional radiographic techniques. By means of an accurate densitometric set, the CT

scanner defines the exact nature of the tissues in the area of the anomaly. CT also allows for the evaluation of the differential density of the soft tissues. The case histories of 12 patients who underwent CT are presented and discussed. (2 Refs)

124. COMPUTED TOMOGRAPHY OF INTRASPINAL AND PARASPINAL NEOPLASMS.

Nakagawa H, Huang YP, Malis LI, Wolf BS
65 East 79th St., New York, NY 10021
J Comput Assist Tomogr; 1(4):377-390 1977

Computed tomography (CT) was used in the evaluation of 36 patients with spinal neoplasms. Of the 36, 19 patients had intraspinal tumors (4 meningiomas, 4 neurofibromas, 3 lipomas, 2 hemangioblastomas, 4 others, 2 ependymomas) and 17 had paraspinal tumors (5 metastatic carcinomas, 3 chordomas, 5 neurofibromas, 1 multiple myeloma, 2 others, 1 ganglioneuroma). Positive CT scans were obtained in 11 of the patients with intraspinal tumors; 4 scans were equivocal, and 4 were negative. Of the intradural extramedullary tumors 5/9 yielded positive CT images, while 3/4 of the extradural intraspinal neoplasms were positive. CT scans of the paraspinal tumors were all diagnostic and provided precise information about the size and extension of the lesion. Eleven of the 17 paraspinal neoplasms were found to extend into the spinal canal, and 13 showed involvement of the bony structures. CT is of diagnostic value particularly in detecting calcified meningiomas, lipomas, and neurofibromas with bony changes. The CT characteristics of each of the different types of spinal neoplasms are discussed. (9 Refs)

125. COMPUTED TOMOGRAPHIC EVALUATION OF THE RETROCRURAL PREVERTEBRAL SPACE.

Callen PW, Korobkin M, Isherwood I
Dept. Radiology, Univ. California Sch. Medicine, San Francisco, CA 94143
Am J Roentgenol Radium Ther Nucl Med; 129(5):907-910 1977

Abdominal computed tomography (CT) scans of 151 patients were reviewed for the presence of discrete structures between the vertebra and the diaphragmatic crura. A distinct retrocrural structure larger than 6 mm in diameter was present in 39 patients. In 112 patients the retrocrural space contained discrete structures smaller than 6 mm or showed no definable structures. Of the 39 patients with retrocrural structures larger than 6 mm in diameter, 37 had clinical and other CT evidence as well as biopsy or lymphangiographic evidence of middle to upper abdominal paraaortic adenopathy. Only three of the 112 patients exhibiting retrocrural structures smaller than 6 mm had such evidence of associated retroperitoneal adenopathy. These three were found to have enlarged nodes, but in the lower rather than the middle or upper abdomen. It is concluded that discrete retrocrural structures larger than 6 mm represent enlarged lymph nodes. Smaller retrocrural structures represent azygous veins or normal lymphatic structures. (Author abstract) (8 Refs)

126. COMPUTERIZED BODY TOMOGRAPHY WITH THE ACTA SCANNER.

Twigg HL, Axelbaum SP, Schellinger D
Georgetown Univ. Medical Center, 3800 Reservoir Road, Northwest, Washington, D.C. 20007
JAMA; 234(3):314-317 1975

The recently developed Georgetown scanner mechanism permits computerized tomography (CT) scanning without a water bath or other absorption-equilibrating medium around the body part being examined. Thus, this ACTA scanner can apply this radiographic technique to the entire body, opening many new areas for clinical investigation and application. In the first 12 mo of use, 1,100 ACTA scans were done. CT proved a simple, noninvasive technique permitting the routine diagnosis of tumor, hematoma, abnormalities of the cerebrospinal fluid-containing spaces, and some infarcts. Despite limitations, extracerebral CT scanning was helpful by adding dimensions to traditional radiographic views. High interest in both commercial and academic circles suggests rapid, if not revolutionary, advancements in extracerebral CT diagnosis.

B. Liver and Pancreas Scanning

127. COMPUTED TOMOGRAPHY OF THE LIVER.

Stephens DH, Sheedy PF, Hattery RR, MacCarty RL
Dept. Diagnostic Roentgenology, Mayo Clinic Mayo Foundation, Rochester, MN 55901
Am J Roentgenol Radium Ther Nucl Med; 128(4):579-590 1977

Experiences gained from the computed tomography (CT) examinations of 1,120 patients are discussed. More than 600 liver examinations were performed. The diagnostic value of CT of the liver depended on proper conduct of the examination, knowledgeable interpretation of the findings, and knowledge of the capabilities and limits of the method. The appearance of the normal liver and its variation and of various hepatic abnormalities are presented. The method of examination, the appropriate use of contrast material, and some of the problems that reduce the technical quality of the examination are discussed. CT was highly accurate in detecting and defining space-occupying lesions and in detecting fatty infiltration; it was less helpful in detecting diffuse hepatic disease. CT displayed the dilated ducts and, frequently, the obstructing lesion in bile duct obstruction. (15 refs)

128. COMPUTED TOMOGRAPHY OF THE LIVER.

Stanley RJ, Sagel SS, Levitt RG
Mallinckrodt Inst. Radiology, Washington Univ. Medical Sch., 510 South Kingshighway, St. Louis, MO, 63110
Radiol Clin North Am; 15(3):331-348 1977

The major strengths and weaknesses of computed tomography (CT) of the liver are reviewed. CT is used most often to confirm the presence and clarify the nature of space-occupying lesions seen with radionuclide imaging, differentiate between medical and surgical forms of cholestatic jaundice, and indicate the level and cause of obstruction. Computed tomograms are included to illustrate their usefulness. (18 Refs)

129. VALUE OF WHOLE BODY COMPUTERISED AXIAL TOMOGRAPHY IN THE DIAGNOSIS OF LIVER DISEASE (MEETING ABSTRACT).

Morris AI, Fawcitt RA, Marsh MN, Isherwood I
Dept. Medicine, Hope Hosp., Univ. Manchester Sch. Medicine, Salford, England
Gut; 18(5):A417 1977

The value of whole body computerized axial tomography (CAT) was assessed and compared with conventional techniques in the diagnosis of 54 patients with various liver diseases. Diagnostically useful information was obtained in 38. In 10/11 patients with total extrahepatic obstructive jaundice, dilated intrahepatic ducts were demonstrated. The primary pathology was demonstrated as carcinoma of the pancreas (5/5), chronic pancreatitis (1/1) and radiolucent gallstones (3/5). In two patients with intrahepatic cholestasis the duct system was normal. Although the CAT was abnormal in 21/22 patients with cirrhosis, the abnormalities were not always diagnostic. In two patients with untreated hemachromatosis a striking increase in hepatic density was noted. Hepatic tumors were detected in four patients with secondary deposits but not in two patients with large primary hepatic carcinomata. Hepatic density was abnormally reduced in three patients with fatty infiltration of the liver but in seven other patients with a

variety of parenchymal liver diseases, including hepatitis, no abnormalities were detected. (no Refs)

130. EARLY EXPERIENCE WITH THE VARIAN SIX SECOND BODY SCANNER IN THE DIAGNOSIS OF HEPATOBILIARY TRACT DISEASE.

Harell GS, Marshall WH, Breiman RS, Seppi EJ
Dept of Radiology Stanford Univ Medical Center Stanford CA 94305
Radiology; 123:355-360 1977

Thirty-four patients with liver disease were studied with a research model of the Varian Six Second body scanner. Useful information was gained in patients with a variety of hepatic disorders. This scanner permits resolution of normal hepatic parenchymal detail which has not been reported previously and has reduced the streak artifacts originating from high- and low-CT objects which have been a major source of image degradation with other units. (10 Refs) (Author Abstract)

131. COMPUTED BODY TOMOGRAPHY.

Alfidi RJ, Haaga JR
Dept. Hosp. Radiology, Cleveland Clinic Foundation, 9500 Euclid Ave., Cleveland, OH 44106
Radiol Clin North Am; 14(3):563-570 1976

Computer tomography (CT), which was developed in 1972-1973, is a significant diagnostic procedure. Its major areas of exploration are the CNS and the detection, staging and biopsy of mass lesions of solid organs within the abdomen. Further development may extend CT to cardiovascular imaging. Computer body tomography (CBT) detects a variety of pleural metastatic lesions virtually undetectable by conventional roentgenograms and conventional tomography. For the liver, CBT is a means of distinguishing obstructive and nonobstructive jaundice, and for spotting nonopaque gallstones. Guided CT transhepatic cholangioraphy has already been performed. CT can detect a pancreatic neoplasm by determining the presence of an abnormal contour; however, the technique will not differentiate between inflammation and neoplasm. CT clearly shows mass lesions of the kidney along with retroperitoneal disorders, infiltrating neoplasms in the mesentery, and aneurisms of the abdominal aorta. CT has had limited application in trauma, but with the use of contrast agents it should be possible to determine which parts of the organs are severed from vascular attachment. CT has clearly demonstrated tumors of the uterus, ovaries, bladder, and bony structures of the pelvis. (10 refs)

132. CT SCANNING OF THE PANCREAS.

Haaga JR, Alfidi RJ
Dept. Hosp. Radiology, Cleveland Clinic, Clinic Center, 9500 Euclid Ave., Cleveland, OH 44106
J Belge Radiol; 59(3):281-286 1976

The value of computerized tomography (CT) in scanning of the pancreas was evaluated. CT scanning demonstrated some specific findings in inflammatory and neoplastic disease. Neoplastic disease produced enlargement of the pancreatic contour and loss of the pancreatic fat plane. A single case of cyst adenocarcinoma demonstrated calcification within a pancreatic mass. The CT scan provided unprecedented imaging of inflammatory disease. It was able to detect inflammatory masses, calcifications within the gland, atrophy of the gland and pseudo cyst. Some pancreatic duct abnormalities were visualized including dilatation and an intraductal calculus. The CT scanners were also useful for guiding percutaneous biopsies; no complications were reported.

133. COMPUTERISED AXIAL TOMOGRAPHY FOR DIAGNOSIS OF PANCREATIC CANCER.

Wiggans G, Schein PS, MacDonald JS, Schellinger D, Harbert J
Div. Medical Oncology, Vincent T. Lombardi Cancer Res. Center, Washington, D.C. 20007
Lancet; 2(7979):233-235 1976

Computerized axial tomography (CAT) was assessed for its ability to demonstrate pancreatic mass lesions in eight men and six women (39 to 78 yr; av age 59) with histologically confirmed pancreatic cancer. CAT demonstrated the presence of a mass lesion in the pancreas in 9 (64%) of the patients. The percentage of false positive and negative results using this technique was not determined. The technique appears accurate in detecting abnormal pancreatic masses of 10 cm in diameter or more; however, for masses less than 10 cm in diameter the yield was only 33%. With further technical refinement to increase resolution, the automatic computerized transverse axial scan should be an invaluable procedure for the detection of pancreatic carcinoma, in designing radiation therapy ports, and in providing objective information regarding response of therapy and progression of primary disease.

134. ABDOMINAL TOMOGRAPHY. PRELIMINARY RESULTS OF COMPUTERIZED TOMOGRAPHY OF THE LIVER AND PANCREAS.

Lamarque JL, Bruel JM, Dondelinger R, Senac JP, Rabischong P, Bonnel F, Laval-Jeantet M, Laval-Jeantet AM
Service Central de Radiodiagnostic, Hopital St.-Eloi, 4, av. Bertin-Sans, F34059 Montpellier Cedex, France
Nouv Presse Med; 6(16):1363-1367 1977

The results of scanning of 120 patients with an Acta Scanner tomometer over a 2-mo period were compared with anatomical section and computed tomography findings in cadavers and isolated livers. This study made it possible to recognize normal structures seen with computed tomography and to identify certain hepatic images which might be sources of error. Serial transverse axial sections were used to reconstruct the whole liver in space, thereby eliminating certain cases of pseudotumoral hepatomegaly. Systematic densitometry permits diagnosis of certain diffuse hepatic disorders. Hepatography using special contrast agents in low doses was used in computed tomography after animal experiments demonstrated the possibility of diagnosis of hepatosplenic tumor lesions less than 1 cm in diameter. (9 Refs)

135. COMPUTED TOMOGRAPHY IN THE EVALUATION OF PATIENTS WITH SUSPECTED CARCINOMA OF THE PANCREAS.

Sheedy PF, Stephens DH, Hattery RR, MacCarty RL
Mayo Clinic, Rochester, MN 55901
Radiology; 124(3):731-737 1977

The authors assess the efficacy of computed tomography (CT) of the pancreas in a series of 151 patients with suspected pancreatic carcinoma. CT diagnoses were divided into four categories based on the original interpretation: "mass" or carcinoma (53 scans); normal pancreas (68 scans); normal pancreas, but another pathologic process was discovered on the CT scan (20 scans); and unsatisfactory or indeterminate examinations (10 scans). In more than 50% of the erroneous diagnoses of pancreatic carcinoma, the mass lesion seen on CT was found at surgery or angiography to be adjacent to, not arising from, the pancreas. False-positive interpretation can be avoided by improved equipment and technique and the accumulation of interpreter experience. (Author abstract) (8 Refs)

136. COMPUTED TOMOGRAPHIC SCANNING OF THE PANCREAS.

Haaga JR, Alfidi RJ

Dept. Radiology, Cleveland Clinic Foundation, Cleveland, OH, 44106

Radiol Clin North Am; 15(3):367-376 1977

The technique and value of scanning by computed tomography (CT) for pancreatic abnormalities are discussed. Patients were examined in the supine position with the gantry angled 10 degrees cephalad and in the decubitus position with the gantry straight. Iodinated contrast material was given before examination in the decubitus position. The appearance of the normal pancreas is discussed. Neoplasms usually produce obliteration of the fat planes around the major vascular structures. Small neoplasms within the gland cannot be detected unless they produce obstruction of the biliary system or distal pancreatic duct. CT scanning is approx 86% accurate in detecting pancreatic neoplasms. Unfortunately, unless only biliary obstruction is seen, the patients are usually inoperable. CT scanning in this case is most useful in determining operability and can aid in biopsy, circumventing the need for laparotomy. CT scanning is effective in diagnosing inflammatory pancreatic diseases when enlargement or density changes are present. It is not as accurate in making these diagnoses as it is for neoplasms. It is also useful for identifying dilation and calcification of the pancreatic duct. If there is a high degree of suspicion of pancreatic disease, CT scanning should be used to make the diagnosis; otherwise, ultrasound is recommended. (7 Refs)

137. COMPUTED TOMOGRAPHY OF THE PANCREAS.

Sheedy PF, Stephens DH, Hattery RR, MacCarty RL, Williamson B

Dept. Diagnostic Roentgenology, Mayo Clinic and Mayo Foundation, Rochester, MN, 55901

Radiol Clin North Am; 15(3):349-366 1977

Experiences over a 17 mo period at the Mayo Clinic, with the application of computed tomography (CT) in patients with symptoms of pancreatic disease are summarized. Technical aspects including equipment, examination technique, CT image of the normal pancreas, location, orientation, size, shape, margins, density and abnormal pancreatic CT findings are discussed. The recognition of carcinoma of the pancreas depends upon the identification of an alteration in the size, shape, configuration, margins, or density of the pancreas. The CT appearance of pancreatitis can be similar to that of pancreatic carcinoma and thus may be difficult to differentiate from carcinoma. Islet cell tumors generally present as large and well-circumscribed masses. Cystadenocarcinomas tend to be large, circumscribed masses associated with peripheral calcification and decreased density. CT diagnosis was accurate in 53 of 61 (87%) patients with confirmed pancreatic carcinoma, and in 25 of 31 (81%) patients with pancreatitis. In evaluation of the negative pancreas, CT was accurate in 83% of the patients. Comparison studies showed that CT was more reliable than ultrasonography, barium gastrotestinal series, nuclear medicine scans and thermography. However, angiography will remain the preferred method for the detection of pancreatic cancer. Most of the cancers detected on CT scans were not resectable. (11 Refs)

C. Urological Tract Scanning

138. UROLOGIC TRACT. (PP. 215-243)

Craven JD

Diagnosis and Staging of Cancer A Radiologic Approach. Steckel RJ, Kagan AR, ed. Philadelphia, WB Saunders Company, 1976.

A radiologic approach to the diagnosis of cancer of the urologic tract is described. It is important to visualize the entire urologic tract in order to select areas that require investigation by tomographic imaging methods. In the areas of the intrapelvic female genital tract, seminal vesicles, prostate, and bladder, computerized axial tomography and gray-scale ultrasound are increasing the precision of roentgenographic diagnosis. The aim of the routine radiographic procedures is to make a correct, firm diagnosis; for example, in renal cell carcinoma, the surgeon must have information about the origin of blood supply, size of the mass, and the presence or absence of tumor extension into the vena cava or the renal vein. It is noted that there are significant limitations in imaging with the routine radiographic techniques used to study the urologic tract. (183 refs)

139. DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS OF SPACE-OCCUPYING LESIONS OF THE KIDNEY BY COMPUTER-TOMOGRAM.

Heuser L, Friedmann G, Modder U, Bischofsberger M, Heising J

Radiologisches Institut der Univ.Klinik Koln, Josef-Stelzmann-Str. 9, 5000 Koln 41, W. Germany

Roentgenblaetter; 30(10):479-489 1977

Computer tomography (CT) scans were done on 76 patients suspected of having space-occupying kidney lesions. Of these, 20/76 were found to have normal kidneys, 18 had malignant tumors, 2 benign tumors, 28 had solitary or multiple cysts, 7 had hydro- or pyonephritis, and 1 had an abscess. CT scans correctly showed the size, shape, and localization of the kidneys. Hydronephritis, solid tumors, and cysts could be diagnosed, but malignant and benign tumors could not be differentiated. Pyonephritis was difficult to/distinguish from a tumor. CT is especially good for the detection of anomalies such as horseshoe kidney. Because CT is noninvasive, it should be done before renal angiography, which may not be needed after CT scanning. (8 Refs)

140. RENAL COMPUTED TOMOGRAPHY.

Struyven J, Osteaux M, Huvenne R, Potvliege R, Jeanmart L

Service de Radiologie, Hopital Brugmann, Place A. Van Gehuchten, Brussels, Belgium

J Belge Radiol; 60(3):281-287 1977

The computerized tomographic evaluation of 100 patients with abnormal iv pyelogram findings using an Ohio Nuclear Deltascan 50 is presented. Patients were scanned in the dorsal decubitus position, and motion artifact was reduced by administration of glucagon. A first series of sections was repeated after administration of 50-100 ml urografine (60%). Tomodensitometric results were compared with surgical, biopsy, or arteriographic findings; 13% of the patients had normal kidneys, 24% had renal neoplasms, 40% had renal cysts, 2% had renal adenomas, 8% had hydronephrosis, 3% had renal aplasia, 4% had retroperitoneal lesions, 3% had inflammatory lesions, and 6% had other disorders. Diagnostic criteria and normal anatomical findings are discussed, and a review of tomodensitometric indications in renal neoplasms, cysts, hydronephrosis, inflammatory parenchymal lesions, and other pathological processes is provided. Computerized tomography resulted in a diagnostic accuracy of approx 90% when compared with ultrasound and arteriography. (6 Refs)

141. COMPUTED TOMOGRAPHY OF RENAL ABNORMALITIES.

Hattery RR, Williamson B, Stephens DH, Sheedy PF, Hartman GW

Dept. Diagnostic Roentgenology, Mayo Clinic, Mayo Foundation, Rochester, MN, 55901

Radiol Clin North Am; 15(3):401-418 1977

The use of computed tomography (CT) in the evaluation of adrenal, urinary tract, retroperitoneal, and pelvic

abnormalities is reviewed. CT's basic uses in the assessment of abnormalities of the urinary tract that affect it either primarily or secondarily include detection, differentiation, and definition of the extent of pathological processes. General indications for CT examination of the genitourinary tract are outlined. Technique and anatomy are reviewed. Tomograms are included to illustrate CT's usefulness in detecting and analyzing renal masses, benign cysts, solid mases, intermediate masses, extrarenal abnormalities, renal atrophy, calcification, hydronephrosis, and anatomy following nephrectomy. CT can be used either as a primary diagnostic imaging method or for further evaluation of detected or suspected tumors. (18 Refs)

142. COMPUTED TOMOGRAPHIC STAGING OF BLADDER NEOPLASMS.

Seidelmann FE, Cohen WN, Bryan PJ
Dept. Radiology, Upstate Medical Center, State University Hosp., 750 East Adams St., Syracuse, NY, 13210
Radiol Clin North Am; 15(3):419-440 1977

The use of computed tomography in the staging of bladder neoplasms was evaluated. Techniques are reviewed, general interpretation guidelines are presented, and potential problems, data display techniques, and accuracy are discussed. Of the 75 patients who were examined using CT, 21 had surgically confirmed findings. Staging was accurate in 17/21 of the patients undergoing surgery. Many of the errors were due to inexperience, and would not occur today. CT's advantages are that it is relatively noninvasive, it can be performed on an out-patient basis, the patient receives minimal discomfort, and prior preparation is unnecessary. Invasion size and area can be accurately measured and displayed in a cross sectional format. To evaluate therapy response or tumor growth, repeat scans can be obtained. With careful monitoring and interpretation, CT is the most accurate technique for staging bladder carcinomas. (13 Refs)

143. COMPUTED TOMOGRAPHY OF GAS-FILLED BLADDER. METHOD OF STAGING BLADDER NEOPLASMS.

Seidelmann FE, Bryan PJ, Temes SP, Patil U, Cohen WN, Sherry RG
750 East Adams St., Syracuse, NY 13210
Urology; 9(3):337-344 1977

A method for the staging of bladder neoplasms with computed tomography of a gas-filled bladder is presented. With this method, direct visualization of the extent of the tumor and adjacent soft tissue structures is possible. The case histories of five patients whose tumors were partially staged by this technique are presented. It is believed that this method will be most useful in the separation of Stage A and B lesions from Stage C and D lesions. (27 refs)

144. COMPUTED TOMOGRAPHY OF THE PROSTATE: INITIAL CLINICAL TRIAL WITH ACTA SCANNER.

Ishibashi A, Ikeda S
Dept. Urology, Sch. Medicine, Kitasato Univ., Kitabasto, Japan
Jpn J Urol; 68(8):745-750 1977

Computed tomography (CT) using the ACTA scanner was used for imaging of the prostate gland. A total of 27 patients with diagnoses of benign prostatic hyperplasia (BPH), carcinoma of the prostate (CaP), and bladder neck contracture (BnC) were studied. In most cases, prostatic regions were clearly delineated by this device. In BPH without prostatitis the prostate gland was seen as an enlarged, homogeneous mass with smooth margins and low density areas corresponding to the urethra. In CaP and BPH with prostatitis the margins of the prostate glands appeared irregular and rough. CT images clearly showed the areas of the prostatic glands which had been resected transurethrally. CT of the prostate gland appears to be a useful method in the diagnosis of prostatic disease. (11 Refs)

145. ADRENAL CORTICAL TUMORS WITH LOW ATTENUATION COEFFICIENTS: A PITFALL IN COMPUTED TOMOGRAPHY DIAGNOSIS.

Schaner EG, Dunnick NR, Doppman JL, Strott CA, Gill JR, Javadpour N
Diagnostic Radiology Dept., NIH, Clinical Center, Building 10, Room 6S211, Bethesda, MD, 20014
J Comput Assist Tomogr; 2(1):11-15 1978

Cases of adrenal cortical tumors with lower than normal attenuation coefficients on whole-body computed tomography (CT) are reported. Normal attenuation coefficients (EU: 500 scale) are between 30-40 EMI units. Of 10 surgically proven adrenal cortical lesions evaluated at NIH by whole-body CT, 4 had attenuation coefficients in the range 8-17 EMI units. Case histories of the four patients are presented. All of these patients had adrenal tumors with high total fat content, which may have been responsible for their lucent appearance. Decreased attenuation has been noted in four other adrenal carcinomas that had undergone spontaneous necrosis or hemorrhage, or which had been embolized prior to chemotherapy. Adrenal tumors with low attenuation coefficients may escape detection by whole-body CT unless there is awareness of this phenomenon. (7 Refs)

D. Breast and Other Soft-Tissue Scanning

146. COMPUTERIZED RECONSTRUCTION TOMOGRAPHY APPLIED TO BREAST PATHOLOGY.

Reese DF, Carney JA, Gisvold JJ, Karsell PR, Kollins SA
Mayo Clinic and Mayo Foundation, Rochester, MN 55901
Am J Roentgenol Radium Ther Nucl Med; 126(2):406-412 1976

The authors show that breast tumors can be clearly defined from the surrounding breast parenchyma by the use of computerized reconstructive tomography. Certain types of fibrocystic mastitis also can be distinguished from tumors, but other types of fibrous mastitis and probably fibroadenomas may not be distinguishable from tumors unless contrast material is used.

147. CLINICAL EVALUATION OF COMPUTERIZED TOMOGRAPHIC MAMMOGRAPHY.

Gisvold JJ, Karsell PR, Reese DF, McCullough EC
Department of Diagnostic Roentgenology, University of Minnesota, Rochester, Minn.
Mayo Clin Proc; 52(3):181-185 1977

This is an initial report of the first clinical study using computerized tomographic mammography (CTM). A study is being conducted comparing CTM and conventional mammographic techniques in patients who subsequently undergo breast biopsy. This report analyzes the experience with 160 breast lesions found in patients who were examined using CTM without contrast material. One hundred lesions were benign and 60 were malignant. Mammography correctly identified 54 of the malignant lesions while CTM identified 41. Five lesions were missed by both modalities. The report also analyzes results experienced with 79 lesions found in patients who were examined with CTM both before and after the intravenous injection of contrast material. Forty-six of these lesions were benign and 33 were malignant. Mammography correctly identified 28 of the malignant lesions while CTM

identified 27. Only one lesion was missed by both modalities. It is planned to continue this study, especially to enlarge our experience with the use of contrast material in breast scanning. (Author Abstract)

148. COMPUTERIZED TOMOGRAPHY AND XERORADIOGRAPHY OF BREAST SPECIMENS.

D'Orsi CJ, Green D
No affiliation given
Breast; 2(4):27-30 1976

To assess the potential role of computed tomography, cadaver specimens of breasts and a surgical specimen of breast cancer were examined using computerized tomography. Four normal breasts from cadavers and one mastectomized breast with the tumor left intact were obtained. Results showed that although computerized scanning provided more accurate information regarding tissue content, xerography was better in giving the actual spatial resolution and anatomic detail that are important in the detection of malignancies. It was concluded that the resolution of computerized tomography must be improved to be able to detect small and presumably early breast tumors. (6 refs)

149. COMPUTED TOMOGRAPHY OF THE BREAST. A PRELIMINARY REPORT.

Chang CH, Sibala JL, Gallagher JH, Riley RC, Templeton AW, Beasley PV, Porte RA
Dept. Diagnostic Radiology, Univ. Kansas Medical Center, 39th and Rainbow Blvd., Kansas City, KA 66103
Radiology; 124(3):827-829 1977

Initial studies indicate that computed tomography (CT) can detect both benign and malignant breast disease in both fatty and dense, thick breast. CT may also be capable of diagnosing early cancer or a precancerous lesion in women with dysplastic breasts or patients who have had radiation therapy or surgery, whereas some of these lesions cannot be diagnosed by mammography because the breast is too dense. (Author abstract) (3 Refs)

150. COMPUTED TOMOGRAPHY BREAST SCANNER (CT/M) (MEETING ABSTRACT).

Chang CH, Sibala JL, Riley RC
Dept. Diagnostic Radiology, Univ. Kansas Medical Center, Kansas City, KS 66103
Invest Radiol; 12(5):408 1977

Computed tomography has been utilized in clinical radiology for the last few yr. However, its application for diagnosing breast diseases is very new. We have been evaluating the General Electric CT/M system at our institution since October 1976. The purpose of this paper is to present our clinical experiences with the unit in 178 patients. The General Electric CT/M is specially designed for breast scanning. The system uses a fan beam x-ray source, a water bucket and 127 high pressure Xenon gas detectors. Different types of breasts eg fatty breasts vs dense dysplastic breasts, present unique diagnostic problems. CT/M results will be compared with conventional mammography for histologically proven cases of benign and malignant lesions. The advantages and disadvantages of this new technique will be discussed. Initial results are very encouraging particularly for the diagnostically difficult dense breast. The CT/M examination can detect a breast cancer and is able to differentiate a malignant lesion from a benign lesion. (no Refs)

151. COMPUTERIZED TOMOGRAPHY OF THE MUSCULOSKELETAL SYSTEM IN CHILDREN: CLINICAL APPLICATIONS (MEETING ABSTRACT). (PP. 16)

Berger PE, Kuhn JP
Children's Hosp. Buffalo, Buffalo, NY
Whole Body Non-Neurological C T Studies Computerized Tomography Seminar Held in Washington, DC, 16 April 1977 Computerized Tomography Society, Washington, DC, 1977.

Our experience with 40 cases of computerized tomography of the musculoskeletal system of children has suggested several potentially very important clinical applications: (1) accurate diagnosis of equivocal osseous abnormalities is difficult to evaluate in areas such as the sacral and iliac bones; (2) soft tissue components of osseous abnormalities may be clearly demonstrated and well localized; (3) primary soft tissue masses may be well demonstrated and the anatomy clearly demonstrated and the anatomy clearly defined prior to surgical extirpation or drainage; (4) localization of foreign bodies is possible; (5) follow-up after radiation and chemotherapy is easily performed; and (6) density changes in the medullary component (marrow cavity) of bone by various pathologic processes permitting evaluation of the extent of a destructive permeative lesion and making a rational approach to therapy such as intraosseous drainage in osteomyelitis and subtotal amputation and prosthetic replacement in osteogenic sarcoma possible. (no Refs)

152. MODERN RADIOLOGICAL EXPLORATION OF THE LYMPHATICS.

Collette JM, Baert A
Hopital Civil, Charleroi, Belgium
J Belge Radiol; 59(6):485-487 1976

Application of radiological exploration of the lymphatic system to diagnosis of various diseases is reviewed. Lymphadenography has proved valuable in distinguishing between various hemo-reticulo-lymphadenopathies such as Hodgkin's disease and chronic lymphatic leukemia. The efficacy of treatment can be determined by the persistance or absence of lymph node opacification. Lymphadenography can determine early metastatic dissemination of neoplasms, particularly those with primary sites in the testicles or ovaries. Computerized tomography is more effective than lymphadenography for an estimation of the total involvement of the lymphatic system in a disease process. The two radiographic methods should be used in a complementary way to plan radiotherapy and chemotherapy of patients with lymph node involvement. (no Refs)

153. COMPUTERIZED TOMOGRAPHY USING THE EMI GENERAL PURPOSE SCANNER.

Kreel L
Div. Radiology, Clinical Res. Centre, Harrow, England
Br J Radiol; 50(589):2-14 1977

The EMI general purpose scanner is briefly described, with particular reference to the use of window height and window width variations. Patient preparation in relation to movement art facts and contrast medium is considered, and a method of localization of tomographic sections is described. The scanner produces brain examinations of high quality. Because a head water bath is no longer required, the base of the skull can also be examined. In the thorax computerized tomography is particularly valuable in showing pleural disease in the forms of thickening, plaques or tumors, and in demonstrating retrosternal lymph node enlargement. Small peripheral metastases can be identified when not shown by conventional tomography. Abdominal lymph node masses, retroperitoneal tumors, and pancreatic disease have been

identified, often more completely than by other methods, or where other methods have failed. The method has proved valuable in the grading of malignant disease and in the monitoring of subsequent treatment, particularly radiotherapy. Metastases in liver and bone can be clearly defined when still quite small (0.5.1 cm), but comparison with other methods of diagnosis such as grey scale ultrasound and isotope scanning will be needed before the role of computerized tomography in evaluating these lesions is known. (8 refs)

154. THE EMI WHOLE BODY SCANNER IN THE DEMONSTRATION OF LYMPH NODE ENLARGEMENT.

Kreel L
Division of Radiology, Clinical Research Centre Harrow, G.B.
Clin Radiol; 27(4):421-429 1976

Thirty-three cases with malignant disease due mainly to lymphoma and testicular tumours were evaluated by computerised tomography (CT) scanning on the EMI general purpose scanner. In many cases there were either more lymph nodes demonstrated than on lymphography or more disease shown in bone or the thorax than was suspected. CT scanning is particularly valuable in showing mesenteric, retrosternal, axillary and para-aortic lymph node enlargement. Bone, liver and pulmonary metastases were shown when not demonstrated by other methods as well as showing the extent of recurrence of malignant disease. In testicular tumours metastatic spread to paravertebral soft tissues behind the diaphragm was clearly demonstrated. This cannot be seen on lymphography. CT scanning appears to be the most accurate method to date of showing the extent of malignant disease, particularly in cases of lymphoma and testicular tumours. (Author Abstract)

VIII. COMPARISONS OF CAT WITH RADIONUCLIDE AND ULTRASONIC SCANNING

A. Radionuclide Comparison

155. COMPUTERIZED TOMOGRAPHY, DIAGNOSTIC ULTRASOUND, AND RADIONUCLIDE SCANNING. COMPARISON OF EFFICACY IN DIAGNOSIS OF PANCREATIC CARCINOMA.

Barkin J, Vining D, Miale A, Gottlieb S, Redlhammer DE, Kalser MH
Div. Gastroenterology, Univ. Miami Sch. Medicine, PO Box 520875, Biscayne Annex, Miami, FL 33151
JAMA; 238(19):2040-2042 1977

A comparison was made of the relative efficacy of computerized tomography (CT), ultrasound (US), and radionuclide (RN) scanning in the detection of pancreatic carcinoma. A total of 46 patients were examined, 33 of whom had pancreatic carcinoma and 13 controls with nonpancreatic diseases. The detection rate was 82% for CT, 92% for US and 96% for RN in patients whose pancreatic carcinomas were verified by either biopsy (28), palpation at laparotomy (4), or by clinical means (1). Radionuclide scans were abnormal in 75% of the patients with nonpancreatic diseases. Pancreatic measurements were similar for both CT and US, but visualization of the pancreas was better with CT. It is recommended that the diagnostic strategy for a patient suspected of pancreatic carcinoma begin with US because its detection rate is equal to that of CT and its cost is substantially less. (7 Refs)

156. RETROSPECTIVE COMPARISON OF RADIONUCLIDE SCANS AND COMPUTED TOMOGRAPHY OF THE LIVER AND PANCREAS.

MacCarty RL, Wahner HW, Stephens DH, Sheedy PF, Hattery RR
Dept. Diagnostic Roentgenology, Mayo Clinic and Mayo Foundation, Rochester, MN 55901
Am J Roentgenol Radium Ther Nucl Med; 129(1):23-28 1977

Computed tomography (CT) and radionuclide examinations of the liver and pancreas in 50 patients were compared retrospectively to evaluate their value as diagnostic tests. CT was superior to Se75-selenomethionine in evaluating pancreatic disease. Both Tc99m-sulfur colloid scans and CT scans were sensitive detectors of liver masses; however, there were more false positive Tc99m-sulfur colloid scans (16% compared to 4%). CT was superior in detecting biliary obstruction and ascites, in assessing diseases that involved the liver extrinsically, and in evaluating the status of adjacent organs. Tc99m-sulfur colloid scans were more sensitive in detection of diffuse nonneoplastic liver diseases (cirrhosis, hepatitis, and cholangitis). Simultaneous interpretation of CT and radionuclide scans was often more helpful than independent interpretation, and the two techniques are therefore complementary. (Author abstract) (8 Refs)

157. COMPUTED CRANIAL TOMOGRAPHY AND RADIONUCLIDE CISTERNOGRAPHY IN HYDROCEPHALUS.

Harbert JC, McCullough DC, Schellinger D
Georgetown Univ Hosp, Washington, DC 20007
Semin Nucl Med; 7(2):197-200 1977

Computerized Cranial Tomographic scanning has replaced radionuclide cisternography in screening both adult and pediatric patients for hydrocephalus. Nevertheless, cisternography provides indispensable information about the CSF clearance capacity and remains a valuable adjunct to the excellent anatomic detail provided by CCT scans. In patients without emergency symptoms, cisternography provides the best indication as to whether or not diversionary shunting is likely to relieve the patient's symptoms. (9 Refs) (Author Abstract)

158. NUCLIDE IMAGING AND COMPUTED TOMOGRAPHY IN CEREBRAL VASCULAR DISEASE.

Chiu LC, Christie JH, Schapiro RL
Dept of Radiology, The Univ of Iowa Hosp and Clinics, Iowa City, IA 52242
Semin Nucl Med; 7(2):175-195 1977

This report presents our experience with computed tomographic and radionuclide scans in 224 patients with ischemic or hemorrhagic infarcts or intracerebral hematomas secondary to cerebral occlusive vascular diseases. The results vary according to the site of vascular occlusion. The radionuclide angiograms and static scintigrams show four distinct patterns in cases of occlusion of the middle cerebral artery. Computed tomographic scans exhibit less variation in appearance and have a higher sensitivity in cases of recent ischemic infarction. The "tentorial confluence sign" is an important finding on static scintigrams in patients with occipital infarction; if this sign is not present, this diagnosis should be suspect. Earlier reports have established the value of computed tomography and radionuclide scans in the evaluation of cerebral infarction. In individual cases, however, each of these modalities may render nondiagnostic or false negative findings; combining both types of examinations and comparing results yield a greater likelihood of an accurate diagnosis of cerebrovascular disease. Computed tomography is clearly more valuable than radionuclide scans in the diagnosis and follow-up of hem-

orrhagic infarcts or parenchymal hematomas. (20 Refs) (Author Abstract)

159. COMPUTERIZED CRANIAL TOMOGRAPHY AND RADIONUCLIDE IMAGING IN THE DETECTION OF INTRACRANIAL MASS LESIONS.

Alderson PO, Gado MH, Siegel BA
Radiology, Johns Hopkins Univ Sch of Med, Baltimore, Md
Semin Nucl Med; 7(2):161-173 1977

Computerized cranial tomography (CCT) and radionuclide imaging (RI) of the brain are both accurate techniques for detecting intracranial mass lesions. CCT is superior in detecting low-grade gliomas, cystic lesions, parasellar tumors, and brain stem lesions. Overall, CCT detection rates are slightly higher than those with RI, but the use of iodinated contrast media with CCT increases the risk of this examination. There is a significant difference in the generally binary (positive/negative) type of information offered by RI and the more specific information offered by CCT about the pathologic nature of a lesion and its precise location. In the evaluation of patients with suspected intracranial mass lesions, CCT is generally the preferable initial diagnostic test. However, RI may still serve as a satisfactory screening examination in certain well-defined clinical situations. (50 Refs). (Author Abstract)

160. THE COMPLEMENTARY ROLE OF COMPUTERIZED AXIAL TRANSMISSION TOMOGRAPHY AND RADIONUCLIDE IMAGING OF THE BRAIN.

Fordham EW
Dept of Nuclear Med, Rush-Presbyterian-St Luke's Med Center, Chicago, Il 60612.
Semin Nucl Med; 7(2):137-159 1977

Computerized axial transmission tomography and radionuclide imaging are complementary procedures, and the following recommendations are made as to their use. Where there is no real clinical suspicion of intracranial disease, either modality can be used for "rule out" screening; the choice can frequently be made on the basis of which modality is cheaper or more quickly available. It should be remembered that "quicker" is often "cheaper." Total cost is determined, not only by the cost of the procedure, but also the per diem costs incurred in waiting for that procedure. Thus the more expensive modality may, in effect, be cheaper if delays are shorter. Screening of the elderly patient, particularly when atrophy or communicating hydrocephalus is of clinical concern, should be by the CT method because of its ability to visualize cerebrospinal fluid spaces. When clinical signs and symptoms point to intracranial abnormality, both modalities should be utilized. If either study done first is normal, use of the other modality is mandatory. When the first study is positive with pathognomonic findings for a specific disease, which totally explains the patient's neurologic problems, the second study need not be employed. Such examples might include the fresh cerebral hemorrhage demonstrated by CT imaging, the AV malformation defined by dynamic-static radionuclide imaging, or multifocal metastatic lesions defined by either. However, when the clinical picture is not totally and satisfactorily explained by the demonstrated disease, the other modality should also be employed. Under many circumstances, neither study will be so reliable, specific, and free of false-negative or false-positive findings as to warrant ignoring the additional information potentially available from the other study. (39 Refs). (Author Abstract)

161. THE CLINICAL EFFICACY AND COST ANALYSIS OF CRANIAL COMPUTED TOMOGRAPHY AND THE RADIONUCLIDE BRAIN SCAN.

Evens RG, Jost RG
Mallinckrodt Inst of Radiology, Washington Univ Sch of Med, 510 South Kingshighway, St Louis, Mo 63110.
Semin Nucl Med; 7(2):129-136 1977

Cranial computed tomography (CCT) has already been demonstrated to provide significant diagnostic information in patients with neurologic disease and to reduce the need for special neuroradiologic procedures. The important question remaining is: Should CCT replace the radionuclide brain scan (RBS) as the first diagnostic study in most patients with suspected intracranial pathology? Data are now available to define the costs and benefits of this substitution. The technical costs of CCT have been determined by a national survey and have shown to be 130 per patient at a volume of 50 patients per week. The costs of RBS at the Mallinckrodt Institute have been estimated at 51 per patient. Data from the literature indicate that CCT is slightly more sensitive and considerably more accurate than RBS. Eighteen to twenty-eight percent of patients studied by CCT and RBS have abnormalities (eg, cerebral atrophy and ventricular dilatation) that are only detected by CCT, and the overall accuracy of CCT is 95%, while the accuracy of RBS is approximately 70%. Substituting CCT for RBS is cost-beneficial. Although CCT is more costly, it increases overall accuracy by approximately 25%. The cost benefit is further increased by the reduction of complicated diagnostic procedures (and associated hospitalization and morbidity) and improvement in diagnostic information for the individual patient. Substituting CCT for RBS may not be more costly because a positive RBS will be followed by CCT (because of increased diagnostic information), and a negative RBS may be followed by CCT (because of increased accuracy), whereas a positive or negative CCT is unlikely to be followed by RBS. (15 Refs). (Author Abstract)

162. EMI SCANNING IN RELATION TO OTHER INVESTIGATIONS OF THE BRAIN.

Gawler J
Natl. Hosp. Nervous Diseases, Queen Square, London, W.C.1, England
Br J Radiol; 48(571):606-607 1975

The use of computerized tomography in the diagnosis of structural intracranial and orbital diseases was reviewed. Cerebral and cerebellar atrophy can be seen on the EMI scan, in addition to hydrocephalus. However, when hydrocephalus involves the entire ventricular system, it may not be possible to state the level of obstruction. Atresia of the exit foraminae of the 4th ventricle cannot be distinguished from basal cistern or tentorial block. The identification rate of cerebral tumors and abscesses by the EMI scanner is as efficient as angiography or pneumoencephalography, and is superior to isotope brain scanning. Gross morphological features such as cysts or capsules can be seen, as well as local complications such as hemorrhage or edema. Tumors lying close to the skull base may be obscured by the superimposition of bone on the tomogram. Cerebral hemorrhage and infarction can be seen, but angiography must be used to visualize vessel occlusion and aneurysms. Calcification can also be detected.

163. REPLY (LETTER TO EDITOR).

Fischer KC
Peter Bent Brigham Hosp., Boston, MA
J Nucl Med; 17(3):224-225 1976

Evidence indicates that the majority of cerebral infarcts are better shown with a bone-seeking radionuclide (HEDP) whereas the majority of tumors are more apparent with the standard " mTc-pertechnetate brain scan. Computed tomo-

graphy and radionuclide brain imaging are complementary studies, especially in the study of cerebral infarctions. Transparent film is a better method of displaying analog data than Polaroid film.

164. COMPUTED TOMOGRAPHY AND RADIONUCLIDE STUDIES IN THE DIAGNOSIS OF INTRACRANIAL DISEASE.

Christie JH, Mori H, Go RT, Cornell SH, Schapiro RL
Univ. Iowa Hosp., Iowa City, IA 52242
Am J Roentgenol Radium Ther Nucl Med; 127(1):171-174 1976

Computed tomography (CT) was compared with radionuclide scintigraphy in a study of 641 patients in an attempt to assess the usefulness and limitations of each technique. Although false negative results were found with CT in 15% of the tests, the results indicated a 90% detection probability with each technique individually and a 95% probability with both techniques combined. CT studies were superior in cerebral, cerebellar or intraventricular hemorrhage and could detect hydrocephalus, porencephaly, cerebral atrophies, benign cysts and developmental abnormalities while radionuclide studies could not. Radionuclide studies were superior in those instances where metallic clips or shunt valves produced CT images of poor quality.

165. SENSITIVITY OF RADIONUCLIDE BRAIN IMAGING AND COMPUTERIZED TRANSAXIAL TOMOGRAPHY IN DETECTING TUMORS OF THE POSTERIOR FOSSA: CONCISE COMMUNICATION.

Mikhael MA, Mattar AG
Mallinckrodt Institute of Radiology, Washington University School of Medicine, St. Louis, Missouri
J Nucl Med; 18(1):26-28 1977

In a series of 25 patients with histologically proven mass lesions of the posterior fossa, computerized transaxial tomography (CTT) and radionuclide (RN) brain imaging detected 23 (92%) and 22 (88%) of the 25 tumors, respectively. In this small group of patients, the difference is not statistically significant. When the results of both techniques were combined, the detection rate was 100%, which emphasizes the complementary value of the two procedures. The two lesions not detected by CTT were metastatic carcinomas, and contract enhancement was not employed. The three lesions not detected by RN imaging were cystic. The results may represent underestimates of the true sensitivity of both techniques since the use of contrast enhancement with CTT and of posterior flow studies and magnified static RN images of the posterior fossa would probably improve the sensitivity of both tests. (Author Abstract)

166. OPTIMAL UTILIZATION OF COMPUTERIZED CRANIAL TOMOGRAPHY AND RADIONUCLIDE BRAIN IMAGING.

Alderson PO, Mikhael M, Coleman RE, Gado M
Edward Mallinckrodt Institute of Radiology, Washington University School of Medicine, St. Louis, Missouri.
Neurology (Minneap); 26(9):803-807 1976

The results of computerized cranial tomography and radionuclide brain imaging in 490 patients were compared in relationship to the patients' clinical presentation. In 195 patients with focal neurologic abnormalities, both tests detected most lesions, but computerized cranial tomography was slightly more accurate overall. Results of both studies were normal in 69 percent of 295 patients with nonfocal neurologic presentations, and radionuclide imaging failed to detect lesions in only five patients with nonfocal presentations. These results suggest that radionuclide imaging can be used to accurately screen most patients with nonfocal neurologic presentations. An exception is the patient presenting with dementia, in whom computerized cranial tomography provides details of the anatomy of the ventricular cavities and cerebral cortex. This study demonstrates a continuing role of importance for radionuclide imaging in the evaluation of patients with neurologic disease and provides data to allow a rational approach to the optimum use of both techniques. (Author Abstract)

167. RELATIVE EFFICACY OF RADIONUCLIDE IMAGING AND COMPUTED TOMOGRAPHY OF THE BRAIN.

Pendergrass HP, Mc KUSICK KA, New PF, Potsaid MS
Department of Radiology, Massachusetts General Hospital and Harvard Medical School, Boston, MA
Radiology; 116:363-366 1975

Computed tomography (CT) with the EMI scanner has been demonstrated to possess a wide spectrum of capabilities in the diagnosis of suspected intracranial disease. This review of 418 dual CT and radionuclide (RN) brain images indicates that RN and CT are complementary in the diagnosis of cerebral infarction, but that CT has a greater capability in brain tumor detection. The classical RN static brain image does not detect cerebral atrophy, hydrocephalus or intraventricular hemorrhage; these conditions are clearly defined by CT. (Author Abstract)

168. COMPUTER TOMOGRAPHY IN POST-MORTEM EXAMINATION OF THE BRAIN AND OTHER SPECIMENS.

Bergvall U, Greitz T, Steiner L
Dept. Neuroradiology, Karolinska Sjukhuset, S-104 01 Stockholm, Sweden
Acta RadiolSuppl (Stockh); 346:39-44 1975

A technique is described for post-mortem examination of brain specimens employing computer tomography. The technique can be used for accurate comparison with in vivo scanning, including subsequent cutting of specimens in sections corresponding to tomographic layers measured.

169. COMPUTED TOMOGRAPHY AND NEURORADIOLOGY: A FORTUNATE PRIMARY UNION.

Baker HL
Mayo Clinic, Rochester, MN 55901
Am J Roentgenol Radium Ther Nucl Med; 127(1):101-110 1976

The value of computed tomography (CT) and neuroradiology at the Mayo Clinic is reviewed. More and more patients are being subjected to CT because of the ease of use and value of the findings. Some of the more hazardous methods of neuroradiology have decreased in use, in spite of their accuracy. Angiography is superior to CT for investigation of vascular lesions of all types and certain intracranial masses. The role of iv injection of iodinated contrast medium is one of the problem areas in that different workers prefer different iodine concentrations. The full potential of CT will only be recognized in the future but two areas of current research are the augmentation of imaging and display capabilities and the extraction of maximal information from CT scan data.

B. Ultrasound Comparisons

170. THE IMPACT OF CT SCANNING AND ULTRASONOGRAPHY ON ORBITAL DIAGNOSIS.

Lloyd GA
Moorfields Eye Hosp., London, England
Clin Radiol; 28(6):583-593 1977

New methods of soft tissue imaging have revolutionized the investigation of the orbit. The impact of computerized

tomography (CT) scanning and ultrasonography is considered in relationship to established techniques including angiography. The importance of plain X-ray examination and conventional tomography is stressed for the exclusion of non-orbital causes of exophthalmos. In the orbit CT scanning is the best method of establishing the presence of a mass lesion; ultrasonography is useful principally for the investigation of optic nerve problems. Venography is still required in most patients to diagnose and establish the extent of a venous malformation in the orbit; it also has an important part to play in the diagnosis of inflammatory processes. Carotid angiography is now only required in patients with highly vascular orbital tumors, or with suspected arteriovenous anomalies. Plain X-ray examination, CT scanning and venography are regarded as the dominant investigations with conventional tomography, ultrasound, and arteriography playing a subsidiary role. (Author abstract) (19 Refs)

171. CT SCANNING AND ULTRASOUND IN THE EVALUATION OF PANCREATIC PSEUDOCYTS: A PRELIMINARY COMPARISON.

Kressel HY, Margulis AR, Gooding GW, Filly RA, Moss AA, Korobkin M
Dept. Radiology, Univ. California Sch. Medicine, San Francisco, CA 94143
Radiology; 126(1):153-157 1978

A retrospective review of 12 surgically proved cases of pancreatic pseudocyst was performed. Computed tomography (CT) correctly demonstrated 6/8 uncomplicated pseudocysts and 4/4 infected pseudocysts. Ultrasound identified 7/8 uncomplicated and 2/4 infected pseudocysts. Errors by one modality are due to limitations not shared by the other method. This suggests a basis for the complementary use of CT scanning and ultrasound in the evaluation of suspected pancreatic pseudocysts. (Author abstract) (11 Refs)

172. COMPLEMENTARY USE OF ULTRASOUND AND COMPUTED TOMOGRAPHY IN STUDIES OF THE PANCREAS AND KIDNEY.

Levitt RG, Geisse GG, Sagel SS, Stanely RJ, Evens RG, Koehler RE, Jost RG
Mallinckrodt Inst. Radiology, Washington Univ Sch. Medicine, 510 S. Kingshighway, St. Louis, MO 63110
Radiology; 126(1):149-152 1978

One hundred thirteen cases of pancreatic and renal disease studied by both ultrasound and computed tomography (CT) were analyzed retrospectively. CT provided a diagnosis when pancreatic ultrasound was unsuccessful due to overlying bowel gas or obesity and when renal ultrasound was unsuccessful due to obesity, reverberations from ribs, small lesions, or multiple lesions. Conversely, ultrasound provided a diagnosis when CT was unsuccessful due to lack of fat planes or respiratory motion. CT usually distinguished carcinoma from pancreatitis when ultrasound showed a focal echogenic mass. CT resolved renal cyst from neoplasm when ultrasound showed a mixed echo pattern mass. (Author abstract) (5 Refs)

173. COMPARISON OF ULTRASOUND AND COMPUTER-ASSISTED TOMOGRAPHY IN PANCREATIC DIAGNOSIS.

Husband JE, Meire HB, Kreel L
Dept. Diagnostic Radiology, Royal Marsden Hosp., Downs Road, Sutton, Surrey SM2 5PT, England
Br J Radiol; 50(600):855-862 1977

Diagnostic ultrasound and computer-assisted tomography (CAT) were compared in a series of patients suspected of having pancreatic disease. The overall diagnostic accuracy of CAT was 84% and that for ultrasound was 64%. However, in those cases in which the pancreas was successfully visualized by ultrasound the diagnostic accuracy was 80%. (16 Refs)

174. COMPUTERIZED TOMOGRAPHY AND ENCEPHALOGRAPHY.

Ruggiero G, Sabattini L, Nuzzo G
Dept. Neuroradiology, Ospedale Bellaria, Bologna, Italy
Neuroradiology; 13(1):45-49 1977

Computed tomography (CT) and encephalography are compared regarding the time involved, the technical difficulties, and the diagnostic values. Since January 1975, 2,477 CT and 718 encephalographies have been performed. Both examinations were found to last approx 30 min. The lateral ventricles often appeared asymmetrical and deformed on CT, even in normal cases, but this did not happen with encephalography. CT is a tomographic procedure only and thus cannot benefit from the general view of the brain offered by encephalography with nontomographic pictures. CT was preferable to encephalography in localizing tumors of the hemispheres, because it could differentiate edema from the tumor itself. The diagnostic possibilities of encephalography were often decreased due to poor filling or nonfilling of the ventricular system. CT must not be considered a substitute for encephalography. On the contrary, in many fields, it is felt that the two techniques are complementary. (10 refs)

175. A COMPARISON OF COMPUTER ASSISTED TOMOGRAPHY (EMI SCANNER) WITH CONVENTIONAL NEURORADIOLOGIC METHODS IN THE INVESTIGATION OF PATIENTS CLINICALLY SUSPECTED OF INTRACRANIAL TUMOR.

Gawler J, duBoulay G, Bull JW, Marshall J
J Can Assoc Radiol; 27(3):157-169 1976

Computerized tomography has been used as the initial radiologic investigation among 212 intracranial tumor suspects. Ninety-five of these patients were ultimately shown to have tumors as a result of all their investigations. Eighty tumors were clearly defined by EMI scanning, four further scans were suspicious but not unequivocally abnormal and six scans showed complications of the tumor rather than the lesion itself. Thus, only five scans were falsely negative in the presence of a tumor. The false positive and false negative rates for EMI scanning have been compared with conventional techniques and computerized tomography was shown to compare favourably with angiography or encephalography. (Author Abstract)

176. CRANIAL ISOTOPIC SECTION SCANNING.

Woolley JL, Williams B, Vankatesh S
Midland Centre for Neurosurgery and Neurology, Holly Lane, Smethwick, Warley, West Midlands B67 7JX, England
Clin Radiol; 28(5):517-528 1977

Some results of isotopic cranial section scanning are presented from a busy neurosurgical practice. Isotopes have been used for parenchymal lesions and also cerebrospinal fluid pathway imaging. Comparisons with information yielded by other neuroradiological techniques have indicated that tomographic sections are a worthwhile addition to rectilinear isotope scans. In particular comparison with X-ray transmission (EMI) scans has confirmed the anatomical accuracy of the method and the two techniques have proved complementary in patient management. (Author abstract) (6 Refs)

177. SKELETAL SCINTIGRAPHY IN CARCINOMA OF THE BREAST (LETTER TO EDITOR).

Isherwood I
Dept. Diagnostic Radiology, Univ. Manchester, Manchester, England
Br Med J; 2(6090):829 1977

Computed tomography (CT) has been successful in differentiating between metastatic and degenerative joint disease even when the two are coincident in the spine, in patients with breast cancer. Lytic deposits not detectable by conventional radiography are demonstrated using CT. Whole body CT should be used in the "positive scan, negative radiograph" situation to avoid unnecessary bone biopsy. (3 Refs)

178. THE IMPACT OF COMPUTED TOMOGRAPHY ON NEURORADIOLOGIC PRACTICE.

Baker HL
Mayo Clinic and Mayo Foundation, Rochester, Minn.
Radiology; 116(3):637-640 1975

To assess the impact of computed tomography (CT) of the head on neuroradiologic and diagnostic practice, we analyzed its capabilities, performance, and usage in our practice during the past 18 months. The results were compared to similar data on other neurodiagnostic test, ie, electroencephalography (EEG), A-mode echoencephalography, cerebral angiography, cerebral pneumography, and nuclide brain scanning. All diagnostic techniques except EEG were used less often as the capabilities of CT became known to our clinicians. (Author Abstract)

179. ULTRASONOGRAPHY AND COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF HOMOGENEOUS MASSES.

Yeh HC, Wolf BS
Dept of Radiology Mount Sinai Hosp Fifth Ave and 100th St, New York, NY 10029
Radiology; 123:425-428 1977

Ultrasonography can demonstrate the homogeneity, while CT can demonstrate the density of a mass lesion. If a mass appears echo-free at ultrasonography, but is denser than water at CT, a solid tumor with grossly uniform cellular structure (usually a lymphoma or sarcoma), or a hematoma or hemorrhagic cyst is likely. However, if the mass has water density at CT, a cystic lesion is confirmed. One case for each category is presented. (2 Refs) (Author Abstract)

IX. CONTRAST ENHANCEMENT

180. DEPENDENT LAYERING OF CONTRAST MEDIUM IN CYSTIC ASTROCYTOMAS.

Kingsley D, Kendall BE
Lysholm Radiological Dept., Natl. Hosp. for Nervous Diseases, Queen Square, London WC1N 3BG, England
Neuroradiology; 14(3):107-110 1977

Dependent layering of contrast medium for computed tomograms in three cystic astrocytomas is reported. Two of tumors contained cysts in which layer formation was present only after iv injection of contrast media. These astrocytomas were in the cerebellum of a 3-yr-old boy and the left frontal lobe of a 15-yr-old girl. The layer of enhancement was thought to be due to the leakage of contrast material into the cysts through the blood-brain barrier. The third case was of a 53-yr-old man in whom the solid part of the lesion was diffusely enhanced after iv injection of contrast medium. A dense, dependent layer appeared in the cyst. That the enhancement was in a layer of fluid was confirmed by rescanning the head at a 30 degree angle. It is suggested that layering of contrast may occur in tumor cysts of various pathologies. (2 Refs)

181. CT-TOMOMETRY. PART 2: DIAGNOSTIC IODINE-CONTAINING CONTRAST MEDIUM.

Kirschner H, Burmester U, Stringaris K
Radiologische Klinik der Universitat Gottingen, Crosslerstrasse 10, 3400 Gottingen, W. Germany
Strahlentherapie; 153(9):616-619 1977

The high absorption-resolution power of the CT scanner allows one to do diagnostic work with a small amount of iodine-containing contrast medium. Data allowing the determination of iodine concentration with the CT scanner are presented. The relation between the delta number (dN) and iodine concentration (mg I/ml) is almost linear. For soft tissue, a dN greater than 0 is obtained in the contrast medium-free scan. To simulate this, glycerol and glycerol-water solutions were examined in addition to aqueous solutions. For dN less than 2,000 but greater than 0, the iodine concentration of the tissue section can be calculated from the difference between the dN of the scan with contrast medium and the dN of the scan without contrast medium. Tables giving the iodine concentration for differences in dN's of 0-2,000 are included. Lighter and therefore less contrasting elements such as potassium, calcium, and iron may also be used in the contrast medium. The relationship between dN and concentration of these lighter elements will not be as simple as for iodine. (1 Refs)

182. CLINICAL EXPERIENCE WITH THE INTRAVENOUS INFUSION OF IODINATED CONTRAST MATERIAL AS AN ADJUNCT TO COMPUTED TOMOGRAPHY.

Huckman MS
Rush-Presbyterian-St. Luke's Medical Center, 1753 West Congress Parkway, Chicago, Ill. 60612
Surg Neurol; 4(3):297-318 1975

Lesions, including metastatic lesions, which are undetectable by conventional computed tomography, may be visualized after iv infusion of iodinated contrast material. For the average adult, an infusion of 300 ml of 25% sodium diatrizoate was used, which delivers a total of 45 mg of iodine. This method also causes lesions that are detectable in the preinfusion tomogram to become better defined. Cystic changes within metastatic lesions will occasionally appear.

183. SODIUM IOTHALAMATE AS AN AID TO DIAGNOSIS OF INTRACRANIAL LESIONS BY COMPUTERIZED TRANSVERSE AXIAL SCANNING.

Ambrose J, Gooding MR, Richardson AE
Atkinson Morley's Hosp., London SW20, England
Lancet; 2(7937):669-674 1975

The diagnostic accuracy of computerized transverse axial tomography in conjunction with enhancement of tissue density by sodium iothalamate was assessed in 438 patients, 256 of them having intracranial tumors and 182 having other intracranial disorders, including degenerative processes, cerebrovascular disease, hydrocephalus, and intracranial infection. The 80 x 80 matrix and 20 ml iv sodium iothalamate were used in 174 patients, the 160 x 160 matrix and 20 ml sodium iothalamate in 126 patients, and the 160 x 160 matrix and 60 ml sodium iothalamate in 138 patients. The diagnostic accuracy rose from 87% in the first group to 100% in the final group. The proportion of patients showing enhancement of tumor tissue density improved from 64% in the first group to 96% in the third. In the non-tumor patients, excluding those in whom the underlying disease caused no alteration of brain structure or tissue density, the overall accuracy was 96%, being

unaffected by the modifications of technique. The enhancement of tissue density in brain abscesses, some cerebral infarcts, and angiomas could be readily distinguished from that seen in tumors.

184. DIATRIZOATE IN COMPUTED CRANIAL TOMOGRAPHY: A QUANTITATIVE STUDY.

Leppik IE, Thompson CJ, Ethier MR, Sherwin AL
Montreal Neurological Inst, Mc Gill Univ, Montreal, Quebec Canada
Invest Radiol; 12(1):21-26 1977

Plasma diatrizoate concentrations during computed cranial tomography were measured by UV spectrophotometry in 14 patients. A loading dose of 0.82 mg diatrizoate/kg followed by a steady infusion of 0.01 mg/kg was required to attain and maintain plasma concentrations of approximately 400 mg/100 ml. Lowering the beam energy resulted in a substantial increase in the EMI numbers of diatrizoate and significant improvement in the delineation of contrast containing lesions. A contrast index estimating the volume of a pixel containing diatrizoate was calculated for five diagnosed lesions and this factor appears to be related to vascularity and extravasation. (16 Refs) (Author Abstract)

185. SUPRASELLAR MASSES ON COMPUTERIZED TOMOGRAPHY WITH INTRATHECAL METRIZAMIDE (LETTER TO EDITOR).

Drayer BP, Rosenbaum AE
Div. Neuroradiology, Dept. Radiology, Univ. Pittsburgh Sch. Medicine, Pittsburgh, PA 15261
Lancet; 2(7988):736-737 1976

A combination of intrathecal enhancement (with the non-ionic myelographic water-soluble contrast agent metrizamide) with computerized tomography (CT) permits the study of the suprasellar and related cisterns with precision and low morbidity. No premedication is needed; 5.0 to 6.0 ml of 190 mg I/ml is introduced into the subarachnoid space; the needle is removed; the patient turned supine, and the table tilted to the 60 degree Trendelenburg position for 1 min. CT scans are then performed. Five verified space-occupying masses (4 chromophobe adenomas and 1 eosinophilic adenoma) were diagnosed and accurately mapped preoperatively by this method which is simple, reliable and safe for accurate diagnosis of a suprasellar mass.

186. COMPUTED TOMOGRAPHIC DIAGNOSIS OF SUPRASELLAR MASSES BY INTRATHECAL ENHANCEMENT.

Drayer BP, Rosenbaum AE, Kennerdell JS, Robinson AG, Bank WO, Deeb ZL
Dept of Radiology Presbyterian-University Hosp 230 Lothrop St Pittsburgh, PA 15261
Radiology; 123:339-344 1977

Ten suspected suprasellar mass lesions were evaluated by CT cisternography (CTC). In each case the cisterns could be defined. Suprasellar mass lesions were found in six. Precise assessment of the anterior, lateral, posterior, and superior extent, made by metrizamide CTC, was verified at surgery. In two masses the intravenously enhanced scan was not diagnostic, while a lesion was visualized by intrathecal (metrizamide) CT. The major diagnostic entity was an enlarged third ventricle. When a chiasmic lesion is suspected and the conventional scan is negative, metrizamide CTC is the examination of choice. (14 Refs) (Author Abstract)

187. CONTRAST MEDIUM ENHANCEMENT WITH TIME IN COMPUTER TOMOGRAPHY: DIFFERENTIAL DIAGNOSIS OF INTRACRANIAL LESIONS.

Hatam A, Bergvall U, Lewander R, Larsson S, Lind M
Dept. Neuroradiology, Karolinska Sjukhuset, S-104 01 Stockholm, Sweden
Acta RadiolSuppl (Stockh); 346:63-81 1975

A summary of the initial experiences gained from a systematic approach to the differential diagnosis of intracranial lesions using computer tomography with the EMI-scanner with the 80 x 80 matrix is presented. Regional changes in attenuation properties after iv administration of Isopaque Cerebral were analyzed in 30 patients with diagnostic categories as follows: no evident intracranial lesion (1), A-V malformation (3), suprasellar chromophobe pituitary adenoma (2), acoustic neuroma (4), meningioma (8), malignant glioma (7), oligodendroglioma (1), medulloblastoma (1), metastasis (1), abscess (1), and vascular occlusion (1). Results of conventional diagnostic procedures and computer tomography without contrast medium enhancement in the various groups of lesions analyzed are presented. There are both technical and biologic problems involved in this type of evaluation. The results of this study suggest that the use of iv contrast medium enhancement with computer tomography does not solve the problems, but rather poses new problems. However, further technical improvements of the scanner, such as a denser matrix and narrow collimation with improved spatial resolution, a shorter scanning time with improved resolution with time (provided that the photon fluence rate can be increased), as well as correlations with special scintigraphic methods may provide a combination of techniques with a high degree of accuracy in the differential diagnosis of intracranial lesions.

188. AN APPROACH TO CONTRAST ENHANCEMENT IN COMPUTED TOMOGRAPHY OF THE BRAIN.

Kramer RA, Janetos GP, Peristein G
Department of Radiology, Palo Alto Medical Clinic, Palo Alto, Calif.
Radiology; 116(3):641-647 1975

A total of 450 brain examinations were performed using computed tomography before and after intravenous infusion of methylglucamine diatrizoate 30%. In 110 cases involving a documented intracranial lesion, the scans were analyzed to determine the degree and usefulness of contrast enhancement. Enhancement was achieved in a wide variety of neoplastic and non-neoplastic lesions and was found to be of considerable help in detection of abnormality as well as in defining tumor morphology. (Author Abstract)

189. AN EXTRAVASCULAR COMPONENT OF CONTRAST ENHANCEMENT IN CRANIAL COMPUTED TOMOGRAPHY.

Gado MH, Phelphs ME, Coleman RE
Neuroradiology Section, the Division of Radiation Sciences, and the Division of Nuclear Medicine, Mallinckrodt Institute of Radiology, Washington University School of Medicine, 510 S. Kingshighway, St. Louis, Mo. 63110
Radiology; 117(3):589-593 1975

One can calculate the tissue-blood ratio of enhancement by analyzing the quantitative aspects of the CT scans of the cranium and blood samples both before and after the injection of contrast medium. This ratio is equivalent to that between the iodine content of a given volume of tissue and an equal volume of blood. Analysis of 47 normal patients, including 27 with pathological brain lesions, indicated that there is significant extravasation of contrast medium in patients with such lesions (Author Abstract)

190. AN EXTRAVASCULAR COMPONENT OF CONTRAST ENHANCEMENT IN CRANIAL COMPUTED TOMOGRAPHY.

Gado MH, Phelps ME, Coleman RE

Neuroradiology Section, the Division of Radiation Sciences, and the Division of Nuclear Medicine, Mallinckrodt Institute of Radiology, Washington University School of Medicine, 510 S. Kingshighway, St. Louis, Mo. 63110

Radiology; 117(3):5950597 1975

The authors provide evidence of significant extravasation of contrast media responsible for the contrast enhancement of pathological tissue on computed tomography. The tissue-blood ratio of enhancement was calculated by the EMI scanner in 2 patients after injection of contrast material and prior to surgery; tumor-blood ratios for red blood cell and plasma tracers were calculated after surgery. The ratios of enhancement demonstrated the analogy between contrast enhancement and the leaking of radionuclide across the blood-brain barrier. This phenomenon may cause error if this technique is used for the measurement of cerebral blood volume. The area for complementary roles of CT and radionuclide brain imaging seems to be narrower than expected. (Author Abstract)

191. THE EFFECT OF DEXAMETHASONE UPON THE ACCUMULATION OF MEGLUMINE IOTHALAMATE AND TECHNETIUM PERTECHNETATE IN CEREBRAL TUMORS AS DETERMINED BY COMPUTER TOMOGRAPHY.

Crocker EF, Zimmerman RA, Phelps ME, Kuhl DE

Univ. Pennsylvania Hosp., Philadelphia, PA

J Nucl Med; 17(6):528 1976

The inhibitory effects of dexamethasone therapy on the level of accumulation of both technetium pertechnetate and iothalamate in four primary brain tumors and four metastatic cerebral metastases are described. The effect appeared within 24 hr after initiation of dexamethasone. (no refs)

192. THE EFFECT OF STEROIDS ON THE EXTRAVASCULAR DISTRIBUTION OF RADIOGRAPHIC CONTRAST MATERIAL AND TECHNETIUM PERTECHNETATE IN BRAIN TUMORS AS DETERMINED BY COMPUTED TOMOGRAPHY.

Crocker EF, Zimmerman RA, Phelps ME, Kuhl DE

Department of Radiology, Hospital of the University of Pennsylvania, 3400 Spruce St, Philadelphia, Pa 19104

Radiology; 119(2):471-474 1976

The effect of dexamethasone on the accumulation of lothalamate and ^{99}mTc pertechnetate in cerebral tumors was investigated in 6 patients over a five-month period. Patients were examined by x-ray (transmission) computed tomography (CT) and by radionuclide (emission)computed tomography (RCT) prior to and during a course of dexamethasone therapy. Steroids diminished the degree of accumulation of both agents but did not change the boundaries of their distribution. (Author Abstract)

193. COMPUTED TOMOGRAPHY: DEMONSTRATION OF CONTRAST MEDIUM WITHIN CYSTIC TUMORS.

Messina AV, Potts G, Rottenberg D, Patterson RH

Neurodadiology Section, Department of Radiology, New York Hospital, Cornell University Medical Center, New York, New York

Radiology; 120(2):345-347 1976

Two cases demonstrated that intravenously injected contrast medium entered cystic lesions. It appears that both vascular opacification and transgression of the blood-brain barrier play major roles in contrast enhancement. (Author Abstract)

194. DIAGNOSIS OF INTRACRANIAL TUMORS BY CT (COMPUTERIZED TOMOGRAPHY) FROM A PRACTICAL POINT OF VIEW.

Elke M, Wiggli U, Hunig R

Rontgendiagnostik, Univ. Inst. fur Med. Radiologie, Kantonsspital Basel, CH-4031 Basel, Switzerland

Radiologe; 17(4):157-170 1977

The mathematical basis for image reconstruction techniques and computerized tomography (CT) is reviewed. The use of iodine contrast media is essential in CT diagnosis of space occupying intracranial lesions since they generally show a characteristic but non-specific absorption pattern. Additional clinical information is needed for a differential diagnostic evaluation. The absorption features of primary and secondary brain tumors with surrounding edema are reviewed. Glioblastomas, as well as metastases, often show a distinct cerebral edema, as observed in 64% of the patients with metastases and 69% of those with distinctly localized high density foci. Of 6,000 patients who underwent CT, 1,708 examinations were performed with contrast enhancement. The side effects were within the range of known reactions of other iv administered contrast media. (79 Refs)

195. INTRODUCTION TO COMPUTERIZED AXIAL TOMOGRAPHY AND THE DIAGNOSIS OF BRAIN TUMOR.

Oi S, Galicich JH

Kobe Univ. Sch. Medicine, Japan

Jpn J Clin Radiol; 21(2):137-145 1976

A review of computerized axial tomography (CT scan) and its application to brain tumors is presented. CT scan is nearly painless; the patient lies supine, with his head enveloped in a rubber "head cone", and held at a predetermined angle, while slit x-ray beams scan the head. No prior medication is necessary. Claustrophobic patients, however, could not be examined adequately. Even a slight body movement interferes with the image. Presence of metal objects in the skull (such as a surgical clip) will also cause artifactual error. If density of the brain tumor tissue resembles that of normal brain tissue, diagnosis becomes difficult, and enhancement by use of contrast medium is helpful. CT scan was conducted on 77 brain tumor cases at Memorial Hospital for Cancer and Allied Diseases (New York, NY) from 1974 to 1975. The cases included 44 metastatic brain tumors; 21 gliomas (supratentorial region); four meningiomas; three pituitary adenomas; three pontine gliomas; one cranio-pharyngioma; and one neurinoma Central cavitation and contrast enhancement from CT scan did not always agree with surgical findings and the features of the actual tumor removed by surgery. (17 refs)

X. ROLE IN THERAPY PLANNING AND EVALUATION

A. Role in Surgical Biopsy and Therapy

196. CT-GUIDED ANTEGRADE PYELOGRAPHY AND PERCUTANEOUS NEPHROSTOMY.

Haaga JR, Zelch MG, Alfidi RJ, Stewart BH, Daugherty JD

Dept. Radiology, Cleveland Clinic Foundation, 9500 Euclid Ave., Cleveland, OH 44106

Am J Roentgenol Radium Ther Nucl Med; 128(4):621-624 1977

The use of computed tomography (CT) as a guidance method for percutaneous puncture of the renal pelvis for either

antegrade pyelography of percutaneous nephrostomy is discussed. Two unilateral antegrade pyelograms and four of five percutaneous nephrostomies (2 bilateral) were successfully performed. The case of a 49-yr-old man with a lower ureteral carcinoma who underwent antegrade pyelogram and of a 65-yr-old woman with hydronephrosis who underwent percutaneous nephrostomy are presented. CT provides cross-sectional images which facilitate accurate needle placement into the renal pelvis. It is capable of detecting subtle density differences within the tissues so that a renal pelvis which does not contain contrast material and is not dilated can be accurately punctured. CT also accurately displays the perinephric space so that assessment of complications is possible. (6 refs)

197. PRECISE BIOPSY LOCALIZATION BY COMPUTER TOMOGRAPHY.

Haaga JR, Alfidi RJ
Cleveland Clinic Foundation, 9500 Euclid Ave., Cleveland, OH 44106
Radiology; 118(3):603-607 1976

The computed tomography-guided aspiration biopsy diagnoses of the renal masses of two men (48 and 50 yr), the abdominal abcess of a 46-yr-old man, the radial malignancy of a 75-yr-old woman, and the pancreatic histiocytic lymphoma of a 55-yr-old man are presented. This technique is advantageous because the CT-guilding allows precise manipulation of the biopsy needle.

198. INTERVENTIONAL CT SCANNING.

Haaga JR, Reich NE, Havrilla TR, Alfidi RJ
Dept. Radiology, Cleveland Clinic Foundation, Cleveland, OH, 44106
Radiol Clin North Am; 15(3):449456 1977

Specific computed tomography (CT) techniques, CT-guided procedures, and the advantages and disadvantages of CT guidance are discussed and experiences with CT-guided procedures in different organ systems are related. There are two basic techniques used for CT-guided biopsies: one uses a single needle and the other uses a double needle method. The single needle technique is typically chosen for use with larger bore needles, while the double needle technique is typically used in fine needle aspirations of the pancreas. Experiences using CT-guided biopsies in the lung, biliary system, liver, pancreas, and genitourinary tract are discussed. Retroperitoneal biopsies, therapeutic procedures, aspiration of intra-abdominal abscesses, percutaneous nephrostomies, and nerve blocks are also considered. The advantages of CT guidance are that CT provides the image of a total cross section of the solid parenchymal organs, major vascular structures, and air containing structures such as the colon and posterior diaphragmatic sulci of the lung; CT gives excellent visualization of anatomic structures; and CT is not affected by surgical wounds, sinuses or ileostomies. The disadvantages of CT-guided methods include the high cost of CT units, the potentially harmful radiation dose, and the time interval involved. (6 Refs)

199. INTRACRANIAL BIOPSY ASSISTED BY COMPUTERIZED TOMOGRAPHY.

Maroon JC, Bank WO, Drayer BP, Rosenbaum AE
Dept of Neurological Surgery, Presbyterian-Univ Hosp, 230 Lothrop St, Pittsburgh, PA 15213
J Neurosurg; 46(6):740-744 1977

A technique is described for biopsying intracranial tumors and aspirating cysts or abscesses using flexible non-metallic needle guides and computerized tomography as a guidance system. Three cases are described in which this technique was used. (6 Refs) (Author Abstract)

200. BRAIN METASTASES: THE BASIS FOR SURGICAL SELECTION.

Wilson CB
Dept. Neurological Surgery, Sch. Medicine, Univ. California, San Francisco, CA 94143
Int J Radiat Oncol Biol Phys; 2(1/2):169-172 1977

Tumors can now be recognized and localized accurately with the use of three diagnostic procedures: cerebral angiography with subtracted films; radionuclide brain scintiphoto; and computerized axial tomography. A second advance in management is improved ability to combat peritumoral edema, whose bulk often exceeds that of the tumor, with the use of glucocorticoids. It is also recognized that grossly total removal of a metastatic tumor with minimal disturbance of uninvolved brain is desirable and achievable by available means of reducing peritumoral edema and elevated intracranial pressure and by improved technical refinements, such as the operating microscope and bipolar coagulation. The selection of patients for operative intervention depends in part on the point in time when a metastatic brain tumor becomes clinically overt. Operation is useful for patients presenting with a single brain tumor and in whom an occult distant primary tumor is not found and for patients having undergone treatment of a localized extracranial tumor in the past and in whom no other site of disease is found; removal of a metastatic brain tumor in a patient who has distant disease can also be an excellent palliative maneuver in certain cases. Favorable and unfavorable factors useful in reaching a decision either for or against surgical treatment are cited and are related to presence and location of extracranial disease, state of health, intracranial pressure, location of brain tumor, response to prior treatment, number of intracranial tumors, and interval between treatment of primary extracranial tumor and diagnosis of brain metastasis. An unequivocal diagnosis is mandatory, and patients with extracranial disease may have an unrelated intracranial process that should not be overlooked. Surgical removal of metastatic brain tumors can produce worthwhile palliation in many properly selected patients, followed by many mo of normal activity and, rarely, a cure. (5 refs)

201. 'SILENT' BRAIN METASTASIS FROM LUNG CARCINOMA DETERMINED BY COMPUTERIZED TOMOGRAPHY.

Jacobs L, Kinkel WR, Vincent RG
Harry M. Dent Neurologic Inst., Millard Fillmore Hosp., 3 Gates Circle, Buffalo, NY 14209
Arch Neurol; 34(11):690-693 1977

Fifty patients with lung carcinoma, who were neurologically asymptomatic and whose radionuclide scans and skull roentgenograms were normal, were subjected to preoperative screening using computerized tomography (CT). Forty-two patients had normal CT examinations. Metastatic tumors were discovered in three patients (6%). These tumors were located in the cerebellar hemisphere, occipital lobe and corpus callosum. Direct visualization of the metastatic lesions was possible only after the administration of contrast fluid. Of the three metastases, only the adenocarinoma was associated with discernable mass effects such as edema, collapse of ventricles or shift of structures. CT findings altered the planned therapeutic regimen, and thoracic surgery was avoided in two patients. (13 Refs)

202. THE PREOPERATIVE APPROACH TO THE HISTOLOGICAL DIAGNOSIS OF BRAIN TUMORS BY COMBINED CLINICAL AND PARACLINICAL EXAMINATIONS (EEG, COMPUTERIZED BRAIN TOMOGRAPHY, SCINTIGRAPHY, ANGIOGRAPHY). A REPORT ON 100 SURGICALLY TREATED ADULTS.

Paillas JE, Bureau M, Farnarier PH, Pasquier J, De Laforte C, Avramov G, Perragut JC
Clinique Neurochirurgicale, Hopital de la Timone, 13385 Marseille, France
Rev Neurol (Paris); 133(6/7):387-399 1977

The following methods of brain evaluation, in their recommended order of application, are discussed: clinical signs, electroencephalography, tomodensitometry, scintigraphy, angiography, stereoangiography, and puncture biopsy. Of 100 patients with surgically treated brain lesions (19 meningiomas, 16 benign gliomas, 38 malignant gliomas, 20 isolated metastases, 8 diversified tumors), the malignancy or benignity of the tumor was determined by multiple examinations in 87 and the tumoral histology was determined in 56. Stereotactically controlled biopsy was able to resolve the diagnosis in uncertain cases. It is concluded that while computerized tomography is capable of discovering or confirming the existence of a suspected tumor, it cannot by itself replace other standard methods of diagnosis. Where surgery is necessary, angiography remains essential. (17 Refs)

203 CT-PATHOLOGIC CORRELATIONS IN HODGKIN'S DISEASE AND NON-HODGKIN'S LYMPHOMA.

Breiman RS, Castellino RA, Harell GS, Marshall WH, Glatstein E, Kaplan HS
Dept. Radiology, Stanford Univ. Sch. Medicine, Palo Alto, CA 94305
Radiology; 126(1):159-166 1978

In order to assess its potential uses in the staging and treatment planning of lymphoma, computed tomography (CT) was performed in 27 newly diagnosed, previously untreated patients with Hodgkin's disease or non-Hodgkin's lymphoma; 18 staging laparotomies provided pathologic correlations. CT detected and defined disease in areas not well evaluated by conventional techniques (high para-aortic, mesenteric, splenic hilar nodes). CT interpretation of splenic size and wt correlated well with splenic wt confirmed at pathology. Nodules were identified in several spleens containing foci of lymphoma. (Author abstract) (9 Refs)

204. CONTRIBUTIONS OF COMPUTED TOMOGRAPHY IN THE STAGING AND MANAGEMENT OF MALIGNANT LYMPHOMA.

Alcorn FS, Mategrano VC, Petasnick JP, Clark JW
Dept. Diagnostic Radiology, Presbyterian-St. Luke's Hosp., West Congress Parkway, Chicago, IL 60612
Radiology; 125(3,part1):717-723 1977

Pretreatment staging is considered essential in the management of patients with malignant lymphoma, particularly nodular sclerosing Hodgkin's disease. The results of computed tomography (CT) examination of 33 patients with malignant lymphoma are correlated with the results of lymphangiography, nuclide images of the liver and spleen, gallium citrate 67 images of lymphoid tissue, and nuclide bone images. CT is least effective in the early clinical stages of malignant lymphoma because normal or minimally enlarged nodes are difficult to detect; CT is probably reliable enough to replace lymphangiography and gallium 67 imaging in patients with advanced disease. (Author abstract) (14 Refs)

205. COMPUTED TOMOGRAPHY AS AN ADJUNCT IN THE STAGING OF HODGKIN'S DISEASE AND NON-HODGKIN'S LYMPHOMAS.

Redman HC, Glatstein E, Castellino RA, Federal WA
Dept. Radiology, Mt. Zion Hosp. and Medical Center, P. O. Box 7921, San Francisco, CA 94120
Radiology; 124(2):381-385 1977

Computed tomography (CT) of the abdomen has been evaluated as an adjunct in the staging of 25 patients with Hodgkin's disease and non-Hodgkin's lymphomas. Enlarged para-aortic nodes were consistently identified as were spenomegaly and larger splenic nodules. While lymphography and other staging procedures remain necessary in the evaluation of such patients, CT provides additional information useful to the surgeon. The cross-sectional display aids in the planning of appropriate therapy ports since the adenopathy is often found to be more extensive than was demonstrated at lymphography. (Author abstract) (3 Refs)

206. COMPUTED TOMOGRAPHIC SCANNING IN THE MANAGEMENT OF RETINOBLASTOMA.

Goldberg L, Danziger A
Dept. Opthalmology, Medical Sch., Hospital St., Johannesburg 2001, South Africa
Am J Ophthalmol; 84(3):380-382 1977

We used the computed tomographic scanner in the assessment of 10 cases of retinoblastoma in children. With each patient the stage of the disease before operation could be more accurately defined and therefore more definite treatment could be undertaken. (Author abstract) (9 Refs)

207. DIAGNOSIS AND TREATMENT OF BRAIN TUMORS.

Walker MD
Section Neurological Surgery, Baltimore Cancer Res. Center, NCI, Baltimore, MD
Pediatr Clin North Am; 23(1):131-146 1976

The diagnosis and management of pediatric brain tumors are reviewed. Tumor types and the natural history of childhood brain tumors differ from those of adults in several respects. Two-thirds of the lesions in children are infratentorial. Headache and/or vomiting are frequently presenting symptoms. Signs vary according to location of the tumor. Diagnostic modalities include the neurologic examination, computerized axial tomography, plain skull films, radionucleotide brain scanning, electroencephalogram, cerebral angiography, and pneumoencephalogram; a lumbar puncture should not be done for diagnosis. Astrocytomas of the cerebellum in children are generally amenable to surgery, while for medulloblastoma, conservative resection followed by irradiation of the entire neuraxis is indicated, keeping chemotherapy reserved for progressive and recurrent disease. Surgical exploration of brainstem glioma should be restricted to those cases in which the diagnosis is in question, radiotherapy being the treatment of choice. Brainstem glioma is ideally situated for intrathecal chemotherapy. Infratentorial ependymoma is treated by careful surgical resection followed by radiotherapy. For astrocytoma and malignant gliomas, surgical treatment is for histologic diagnosis and reduction of tumor burden. Modest palliation may be obtained with 5,000-6,000 rads. For supratentorial ependymomas of the cerebral hemispheres, judicious resection should be performed and consideration given to radiotherapy. Craniopharyngiomas are very difficult to manage surgically, and total excision is rarely possible. Postoperative radiation has produced excellent results. (37 refs)

208. THE MANAGEMENT OF CEREBRAL METASTASIS.

Lokich JJ

Sidney Farber Cancer Cent., Peter Bent Brigham Hosp., Harvard Med. Sch., Boston, Mass.

JAMA; 234(7):748-751 1975

The clinical features, diagnosis, and therapeutic approaches to cerebral metastases are discussed, and 2 illustrative cases are briefly cited. Tumors of the bronchus and breast and malignant melanomas are the most common solid tumors developing cerebral metastases, but genitourinary and gastrointestinal tumors and soft-tissue sarcomas may also enter the CNS. Symptoms are usually secondary to increased intracranial pressure or to the direct invasion of the neurologic structures. Diagnostic procedures include electroencephalogram, echoencephalography, radionuclide scanning (Tc 99m), computerized axial tomography, lumbar puncture, and arteriography. Determinants of the therapeutic approach include the number, size, site, and depth of metastasis, the origin of the primary tumor, the biologic behavior, the disease-free interval, the responsiveness of the tumor to chemotherapy or radiotherapy, and the quantitative host tumor burden. Neurosurgical approaches include decompression, tumor excision, and cerebrospinal fluid-vascular shunt. A 26-yr-old woman with a solitary cerebral metastasis from a soft-tissue sarcoma of the thigh did not respond to radiotherapy but was alive without recurrence 12 mo after surgical excision of the cerebral metastasis. Radiation is the major therapeutic modality for CNS lesions from breast and bronchogenic cancer. Generally, 2,500-4,000 rads are delivered to the whole brain over a 10-14 d period, with a proportion of the total dose coned down to the primary lesion. A 40-yr-old woman developed a solitary parietal lobe lesion 2 yr after removal of an ovarian carcinoma. She was treated with radiotherapy and dexamethasone (16 mg/d in divided doses). Five mo later steroid therapy was discontinued, the pt was asymptomatic, and the brain scan showed improvement. This pt did not have pulmonary lesions. Surgery was not used because of the sensitivity of the tumor to radiotherapy and chemotherapy. Results of chemotherapy for brain lesions has not been encouraging, perhaps because of the inability of most drugs to cross the blood-brain barrier. Nitrosoureas and podophyllin derivatives, because of their lipid solubility and ready access to the CSF, have been employed. Steroids have been used to interrupt the acute clinical effects of CNS metastases by reducing cerebral edema and altering blood flow. Dexamethasone (16 mg/d in divided doses is recommended beginning 1-2 d before surgery or radiotherapy, with reductions in dose at 7 d intervals and cessation of steroids by the 35th d. (19 refs)

209. THE CLINICAL CHARACTERIZATION OF HUMAN TUMOURS IN RELATION TO TREATMENT AND PROGNOSIS. (PP. 185-192)

Peckham MJ

Biological Characterization of Human Tumours, Proceedings of the Sixth International Symposium on the Biological Characterization of Human Tumours, Copenhagen, May 13-16, 1975. New York, American Elsevier Publishing Co Inc, Advances in Tumour Prevention, Detection and Chara 1976.

Since the predominant forms of potentially curative tumor treatment remain radiotherapy and surgery, it is important that the position and extent of the tumor are determined as accurately as possible. Localization may be achieved by clinical staging methods and by pathological staging techniques whereby microscopic spread in sampled tissues may be demonstrated. Important new methods of localization include pedal lymphangiography, computer-assisted x-ray tomographic technique, ultrasonography, and isotopic scans. Staging allows separation of patients into prognostic groups, and within a staging category, other biological factors may be recognized and form a valuable basis for selective therapy for the at risk group. After localization, treatment should attempt to render bulky tumor (primary and secondary) curable with radiotherapy alone or combined with surgery or cytotoxic agents. Patients with distant, subclinical metastases should be treated initially with systemic chemotherapy in addition to local measures. It is noted that the clinical problem is to identify the 30% of the patients at risk of developing such metastases. For example, in malignant teratoma of the testis, initial adjuvant chemotherapy would be useful for patients with pulmonary metastases; and attempts are being made to identify the 30% who need elective adjuvant chemotherapy by using markers such as a-fetoprotein and detailed pathological staging of the primary tumor (venous and lymphatic invasion). Direct surgical staging procedures have been particularly valuable in the malignant lymphomas. Results show that when radical treatment of Hodgkin's disease is based upon precise staging, staging may become less of a prognostic determinant and that histological grade has become less marked since treatment has been based upon accurate disease localization. Also, experience has led to the identification of two groups of patients in whom chemotherapy is indicated in addition to radiotherapy. Those patients treated primarily with chemotherapy tend to have relapses involving the bulkiest lymph nodes, and the value of adjuvant radiotherapy in these patients is being tested. Experiences with other cancers (abdominal metastases in malignant teratoma, cervical node metastases in squamous cell head and neck carcinoma, and rectal carcinoma) are also cited which demonstrate that therapeutic response is related to tumor vol. (7 refs)

210. SERIAL COMPUTED TOMOGRAPHY OF PRIMARY BRAIN TUMORS FOLLOWING SURGERY, IRRADIATION, AND CHEMOTHERAPY.

Marks JE, Gado M

Div. Radiation Oncology, Mallinckrodt Inst. Radiology, 510 S. Kingshighway, St. Louis, MO 63110

Radiology; 125(1):119-125 1977

Fifty-five patients with primary brain tumors were studied by computed tomography (CT) scans before, during, and after treatment to determine chronological changes in morphology. Pretreatment scans showed decreased density in most glioblastomas and low-grade astrocytomas and normal density in most unbiopsied tumors and optic nerve gliomas. All glioblastomas and 40% of the astrocytomas were enhanced by contrast material, suggesting that the latter tumor can be divided into two prognostic categories based on the presence or absence of enhancement. Lesion size regressed after treatment in 62% of patients, stabilized in 29%, and progressed in 9%. CT findings correlated with the clinical course in 93% of cases. Seventy-three percent of tumors persisted, 20% disappeared, and 7% recurred after a mean follow-up of 10.1 mo. (Author abstract) (9 Refs)

B. Role in Radiation Therapy

211. CT DETERMINATION OF PARAMETERS FOR INHOMOGENEITY CORRECTIONS IN RADIATION THERAPY OF THE ESOPHAGUS.

Fullerton GD, Sewchand W, Thomas DJ, Payne JT, Levitt SH

Therapeutic Radiology Dept., Univ. Minnesota, Minneapolis, MN

Radiology; 126(1):167-171 1978

Accurate dose prediction for megavoltage photon therapy of carcinoma of the esophagus requires information on tumor

depth, lung thickness, and lung density. The authors found that computed tomogram (CT) localization of internal and external contours is accurate within +- 1 mm. Lung density can be measured with an error of less than than 0.02 g/cm³ in the range 0.25-1.00 g/cm³. Variance between predicted and measured dosage less than than 3% in all patients and in most RANDO phantom measurements. Accurate radiation therapy planning is possible with CT information from a commercial scanner. (Author abstract) (9 Refs)

212. WHOLE-BODY COMPUTERIZED TOMOGRAPHY IN THE PLANNING AND FOLLOW-UP OF RADIATION THERAPY.

Hermann HJ, Schnabel K, Zum Winkel K

Universitats-Strahlenklinik (Czerny-Klink), Vossstrasse 3, 6900 Heidelberg, W. Germany

Fortschr Geb Roentgenstr Nuklearmed; 127(5):405-414 1977

Whole body computed tomography as a means of providing accurate transverse sections of areas to be irradiated and the positions required for irradiation is discussed. Of 167 malignant tumor patients participating in the study, 55 had tumors of the pelvis, 41 had tumors of the thorax, 24 had tumors of the brain and facial regions, 17 had tumors of the lymph system and lymph node metastases, 15 had renal tumors, 10 had skeletal tumors, 2 had thyroid tumors, 1 had a stomach carcinoma, 1 had abdominal wall metastases, and 1 had a soft tissue infiltration with a plasmocytoma. Accurate delineation of the tumor or the area of irradiation was seen in 135 patients. In 66 patients computed tomographic scanning provided additional information on the extent of the tumor. Artifacts were seen in 22 cases but the data were nevertheless usable. For 32 patients the computed tomography provided inaccurate results due to artifacts from contrast medium, postoperative air or metal clips. Computed tomography may also be employed in the determination of tissue density which is essential when megavolt therapy with fast electrons is used. The computed tomograph allows for an accurate irradiation plan since it permits an exact determination of the target volume and the position of the neighboring organs. This information is especially valuable for obese patients. (23 Refs)

213. DELAYED RADIATION NECROSIS OF THE BRAIN.

Martins AN, Johnston JS, Henry JM, Stoffel TJ, Di Chiro G

Neurosurgery and Radiation Therapy Services, Walter Reed Army Medical Center, Neuropathology Branch, Armed Forces Inst. Pathology, Washington, DC

J Neurosurg; 47(3):336-345 1977

The cases of six patients are presented to delineate the clinical profile of delayed radiation necrosis of the brain. In five the diagnosis was verified histologically. Symptoms most often begin 9 mo to 2 yr after radiotherapy. Progressive visual impairment and dementia are common following perisellar irradiation, while hemispheric signs predominate following irradiation of the cerebrum. Cerebrospinal fluid protein may be elevated. Focal delta slowing is usually present on electroencephalography. The necrotic brain may appear on radionuclide brain scan as an area of abnormal uptake and also act as an avascular space-occupying lesion. With computerized tomography, radiation necrosis appears as an intracerebral area with diminished absorption coefficient that is often enhanced with iv contrast medium. The syndrome may be sufficiently characteristic to eliminate the need for surgical exploration and biopsy in some cases. Cumulative experience suggests that the risk-to-benefit ratio of radiotherapy becomes increasingly unfavorable for most patients with benign intracranial neoplasms when the standard brain tumor dose of 5,000 to 7,000 rads is fractionated at greater than 200 rads per day. (Author abstract) (20 Refs)

214. USE OF BODY SCANNER IN RADIOTHERAPY TREATMENT PLANNING.

Munzenrider JE, Pilepich M, Rene-Ferrero JB, Tchakarova I, Carter BL

Dept. Therapeutic Radiology, Tufts-New England Medical Center, 171 Harrison Ave., Boston, MA 02111

Cancer; 40(1):170-179 1977

Computerized tomography (CT) body scans obtained on 98 patients before, during, and after radiotherapy were evaluated for their utility in radiotherapy treatment planning and in follow-up after radiotherapy. Twenty-two patients were studied after irradiation. Four received additional treatment, and continuing or planned treatment was withheld from another four on the basis of CT data. Tumor extent was clearly delineated on CT scan in 48/76 cases (63%), suggestive in 25/76 (33%), and not seen in only three (4%). Utilizing CT data relative to all other available tests, in 75 patients, total treatment vol was altered in 34 (45%), tumor coverage was marginal or inadequate in 35 (47%), and vol of normal tissue irradiated was changed in 34 (45%). CT scan data was judged essential for treatment planning in 41, or 55%, of patients studied. Unsuspected areas of tumor involvement were seen in 32 of 75 cases (43%). Use of the CT scan as a patient contour for radiotherapy treatment planning and alternative techniques for inputing the CT data to treatment planning computers are discussed. A simple inexpensive device to accomplish this is described. Speculations are made regarding the impact of CT scanners on transverse axial tomography units and treatment simulators as well as the potential application of the technique in brachytherapy dose computation. (11 Refs)

215. THE USE OF CT SCANNERS IN MEGAVOLTAGE PHOTON BEAM TREATMENT PLANNING (MEETING ABSTRACT).

Geise RA, McCullough EC

Rocky Mountain Medical Physics, Inc., Littleton, CO 80124

Med Phys (Lancaster); 4(4):359 1977

The value of computer tomography (CT) scanners in assisting in making inhomogeneity corrections in treatment planning for megavoltage photon beam radiotherapy has been assessed. Presently used inhomogeneity correction factors satisfactorily correct isodose curves behind inhomogeneities of simple geometry. Lateral inhomogeneity perturbations were found to be small for megavoltage photon beams indicating complex computational schema and large computing systems are uncalled for. For inhomogeneities similar to those of interest in treatment planning an uncertainty of 8 to 10% in electron density and 4 to 5mm, in size leads to error in the dose correction factor of about 2%, indicating direct access to CT numbers is unnecessary for treatment planning. (no Refs)

216. CT DETERMINATION OF PARAMETERS FOR INHOMOGENEITY CORRECTIONS IN RADIATION THERAPY OF THE ESOPHAGUS (MEETING ABSTRACT).

Fullerton GD, Sewchand W, Payne JT, Levitt SH

Dept. Therapeutic Radiology, Univ. of Minn., Minneapolis, MN 55455.

Med Phys (Lancaster); 4(4):359 1977

Tumor and critical organ location within the patient are crucial to successful radiation therapy. In this paper we study the accuracy of esophogeal dosimetry based on computer tomography (CT); we directly confirmed results in the patient with LiF TLD measurements. Contours can be localized with an accuracy of +-1mm CT measures of relative density showed a max error of 1.4% the density of water in the range 0.25 to 1.00. Comparisons of predicted and measured doses

were made in vivo in patients and in a RANDO phantom with beam energies of 10 million volts (MV), 4MV and £o60. Disagreements were less than +-3% in all patient studies and most of the RANDO measurements. (no Refs)

217. USE OF BODY SCANNER IN RADIOTHERAPY TREATMENT PLANNING (MEETING ABSTRACT).

Munzenrider JE, Pilepich M, Rene-Ferrero JB, Tchakarova I, Carter B

New England Medical Center Hosp., Boston, MA

Int J Radiat Oncol Biol Phys; 1(Suppl):103-104 1976

One hundred and seventy body section computer-assisted tomographies were performed, with 64 (38%) being done on patients with known malignancy. In fifty patients, the scans were available during treatment planning for radiotherapy. Treatment vol as usually determined, (including physical exam, operative notes, isotope scans, radiographic procedures and ultrasound techniques) was compared with the treatment vol as determined by the body scan. A method for recording skin portal marks on the scan was developed. Techniques for magnification of the scan to accurately portray patient contour in the treatment position are described. Use of these contours with Artronix 12 treatment planning system allowed optimization of dose distribution in the vol of interest, and minimization of radiation dosage to normal structures to a degree not possible with other methods. (no refs)

218. COMPUTER TOMOGRAPHY OF THE WHOLE BODY AS A MEANS OF RADIATION PLANNING.

Schnabel K, Guillaume R, Hermann HJ, Schlegel W, Zabel HJ

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Strahlentherapie; 153(1):51-56 1977

Whole body computed tomography is discussed. With this technique, individual tomograms with high resolution and in correct scale can be obtained; large copies can be obtained with the use of the "Sicograph." The size and location of tumors relative to critical organs can be exactly determined. The efficacy of radiation therapy in each case can be estimated on the basis of the controlled course and the necessary modifications of the therapeutic schedule can be made early, allowing the complete utilization of the advantages of the shrinking field technique. Since ultrasonic tomographs frequently provide additional information, the combination of computed and ultrasonic tomography are recommended in radiation planning. (32 refs)

219. THE USEFULNESS OF COMPUTED TOMOGRAPHY DURING AND AFTER RADIATION THERAPY IN PATIENTS WITH BRAIN TUMORS.

Pay NT, Carella RJ, Lin JP, Kricheff II

Dept. Radiology, Div. Neuroradiology, New York Univ. Medical Center, New York, NY

Radiology; 121(1):79-84 1976

The serial study of brain tumors during and after radiation therapy has shown that computed tomography is useful in the depiction of regression or growth of primary and metastatic intracranial tumors; recognition of side effects of radiotherapy, such as necrosis and edema; and evaluation of changes in tumor density and ventricular size. Representative case histories are presented and illustrated. (no refs)

220. RADIATION TREATMENT PLANNING.

Laughlin JS, Chu F, Simpson L, Watson RC

Memorial Sloan-Kettering Cancer Center, 1275 York Ave., New York, NY 10021

Cancer; 39(2,Suppl):719-728 1977

Developments in radiation treatment planning are reviewed, with particular emphasis on the use of automated techniques. Dose computation has been made manageable by the development of automatic computation technology and programming. Other innovations include body contouring devices for the determination of external patient contours, methodology for the determination of effective internal tissue density, computer programming and dosimetry for moving shadow blocks, methodology for the precise location of internally implanted sources, optimization programs for automatic computation of the best implanted source loading, transverse axial (radiographic) tomography, ultrasound, and computerized transverse tomography. Computation of the dose distribution in all desired planes must take into consideration the effect of beam modifiers, the heterogeneous tissue structure, and any unusual requirements with respect to the patient position relative to the source. Beam modifiers may include conventional wedges, shadow blocks of various configurations, and moving shadow blocks. Computerized transverse tomography is valuable in determining the effective density of internally located tissue that in turn is important for the accurate computation of radiation dose distribution. Examples of the utilization of the above techniques in external radiation planning are cited for the following cases: a patient with a large tumor mass in the lung (treatment limited by pulmonary and subcutaneous fibrosis from previous radiation therapy), a patient with recurrent epidermoidal carcinoma in the pelvis, a case of recurrent breast carcinoma, a case of biopsy-proven Grade II chondrosarcoma, and a case involving metastases from breast cancer with lesions located retro-orbitally and in the ethmoid sinus. An example of ^{125}I seed implantation for a left lung lesion is also illustrated. (13 refs)

221. TREATMENT PLANNING IN RADIATION THERAPY.

Simkins T

No affiliation given

Appl Radiol; 6(3):119-124 1977

The adaptation of the computer to radiation therapy planning is discussed with a brief historical account and recommendations for future use. The use of ultrasound techniques as a new means of obtaining better information for treatment planning is also discussed. A new method called computed tomography scanning is presented as the most advanced means of diagnostic treatment planning. The method of injecting contrast materials gives the best cross-sectional images of the body. (20 Refs)

222. NEW DIMENSIONS IN COMPUTED TOMOGRAPHY.

Jelden G, Sufka B, Arnold J, Rodriguez-Antunez A, Doering E, Lavik P, Turnbull R

Dept of Radiotion Therapy, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, Oh 44106.

Radiology; 123(1):213-215 1977

Total body CT scanning may be utilized as a means of treatment planning for radiation therapy. Computer reconstruction of coronal and sagittal views from CT cross-sectional slices was accomplished by taking each of the cross-sectional images and placing them together in the specific order in the sequence in which they were scanned to form a cube. Once the cube is built, retrieving the sagittal and coronal views is readily achieved. (2 Refs). (Author Abstract)

223. COMPUTED TOMOGRAPHIC LOCALIZATION FOR RADIOTHERAPY OF CEREBRAL TUMORS.

Zimmerman RA, Bilaniuk LT, Grundy G, Littman P

Hosp. Univ. Pennsylvania, 3400 Spruce St., Philadelphia, PA 19104

Radiology; 119(1):230-231 1976

A method of accurately localizing cerebral neoplasms for the purpose of therapeutic management is described. The x-ray

tube of the EMI head scanner is used to make exposures in the lateral and posteroanterior positions. A lightweight cassette with high speed screens and par speed film is attached to the head-holding plexiglass box opposite the x-ray tube. The scanner is started. Two traverses are sufficient to expose the x-ray film when utilizing 120 kV at 32 mA. Posteroanterior and lateral radiographs are obtained following the computed tomography scan. Superimposed upon each skull radiograph are the images produced by the traverse of the x-ray beam; these images correspond to the levels of the plane of each set of sections.

224. FURTHER PROGRESS IN CT SCANNING AND COMPUTERIZED RADIATION THERAPY TREATMENT PLANNING.

Jelden GL, Chernak ES, Rodriguez-Antunez A, Haaga JR, Lavik PS, Dhaliwal RS
Dept. Radiation Therapy Nuclear Medicine, Cleveland Clinic Foundation, 9500 Euclid Ave., Cleveland, OH 44106
Am J Roentgenol; 127(1):179-185 1976

A method of treatment planning which uses the imaging technique of computerized tomography (CT) scan combined with a radiation therapy computer is presented. The initial step is to obtain a series of CT scans throughout the entire tumor-involved area; the scan that occupies the central axis of the therapy beam is used as the representative scan. The information obtained from the CT scan is then entered into a computer used for radiation therapy treatment planning. A computerized scan is created which outlines the patient contour and vital anatomy, allowing more efficient use of the computer. Beams of various sizes can be entered and positioned to suit individual anatomy.

225. POSSIBLE APPLICATION OF A RADIOTHERAPY SIMULATOR FOR IMAGING OF BODY CROSS-SECTIONS (LETTER TO EDITOR).

Harrison RM, Farmer FT
Regional Medical Physics Dept., Newcastle General Hosp., Newcastle upon Tyne NE4 6BE, England
Br J Radiol; 49(585):813 1976

Because of the expense of a computer tomography scanner, the possibility of gaining the same information with a radiotherapy simulator and a digital computer was investigated. An x-ray beam, collimated to a narrow fan of angle was directed to form an image on a fluorescent screen. The image was digited and stored in a computer. Futher projections were taken by rotating the gantry; a reconstruction was eventually made by the computer. Although this method is less sensitive that the commercial scanner, it utilizes a machine that is readily available perhaps more efficient and less expensive.

226. THE RADIATION THERAPY SYSTEM AT SAHLGRENSKA SJUKHUSET IN GOTEBORG. (PP. 43-47)

Lindskoug B, Johansson KA, Notter G, Ragnhult I, Fridh L
Computer Applications in Radiation Oncology
Proceedings of the Fifth International Conference on the Use of Computers in Radiation Therapy. Sternick ES, ed. Hanover, University Press of New England, 1976.

The radiation therapy system at Sahlgrenska Sjukhuset in Goteborg is discussed. The dose planning, radplan, patient outlines, scope, internal tomography, treatment scheduling, verification of dose plans, and patient flow and records are considered. It appears that a relatively inexpensive minicomputer system can be useful. Both the SCOPE and the ACTA or EMI scanners will give extensively automated and rational procedure. Frequent checks and verifications of the calculated dose plans are necessary and may be made in vivo using a semiconductor system or an automated TLD reader with computer adapted output. (5 refs)

227. THE USE OF COMPUTED TOMOGRAPHY IN RADIATION THERAPY TREATMENT PLANNING.

Jelden GL, Chernak ES, Lavik PS, Dhaliwal RS, Rodriguez-Antunez A
Dept. Radiation Therapy and Nuclear Medicine, Cleveland Clinic, 9500 Euclid Ave., Cleveland, OH 44106
J Belge Radiol; 59(3):301-307 1976

Previous methods of obtaining contours of the body have been time-consuming and inaccurate. The ultrasound unit allows a contour to be obtained which is reasonably accurate, but representations are limited to the abdomen, retroperitoneal area, pelvis, neck, and chest wall. The successful use of a total body computed tomographic (CT) device and a computer for radiation therapy treatment planning is described. The pictures are taken with the patient in treatment position, which allows an individualization of treatment planning. The image obtained by the CT scanner is a detailed cross-sectional anatomical representation of any level throughout the body: head and neck, thorax, or abdomen. The initial step is to obtain a series of CT scans throughout the entire tumor-involved area. The scan occupying the central axis of the therapy beam is chosen as the representative scan. This image is studied for extension of the tumor and localization of vital structures and is then transferred to the computer by tracing the image (a density scan) with a calibrated rho theta device. This simplified representation allows the pathological process to be treated and the normal structures to be spared from radiation injury, and thus the efficient planning of treatment. Tissue inhomogeneities produced by bone and structures containing air present no difficulties in dosage calculations when the CT scanning and radiation therapy computers are used. (1 ref)

228. TUMOR LOCALIZATION TECHNIQUES IN RADIATION THERAPY.

Anonymous
No affiliation given
Cancer Suppl ; 37(4):2035-2045 1976

Radiation therapy techniques currently available require better tumor definition, as well as more precise identification of critical and vital structures within the volumes being irradiated. New imaging techniques with radionuclides, computed tomography, ultrasonund, and soon offer great potential applications in radiation therapy. Better staging, better definition of the volume to be irradiated, better read-out mechanisms for demonstration of cross-sectional anatomy, as well as for early detection of recurrent or metastatic disease are possible with these techniques. New imaging techniques need to be centered on the evaluation of tumors involving the lung, liver, pancreas, breast, bone, and soft tissue, with appropriate weighing of risk versus cost, as well as the potential for detection of tumor before metastases have developed and before symptoms are present. Potential contributions of computerized tomography, acta-scanners, ultrasound, image recording, holography images, thermography, three dimensional tomography, automated techniques, and biopsy techniques to the more appropriate definition of tumor volume and definition of clinical and vital structures are discussed. The present state of the art suggests that a more intimate integration of physics, technology, engineering, and computer technology will become apparent in the field of diagnostic radiology. (11 refs)

229. COMPUTERIZED (AXIAL) TOMOGRAPHY IN THE SERIAL STUDY OF CEREBRAL TUMORS TREATED BY RADIATION: A PRELIMINARY REPORT.

Carella RJ, Pay N, Newall J, Farina AT, Kricheff II, Cooper JS

Div. Radiation Oncology, New York Univ. Medical Center, 566 First Ave., New York, NY 10016

Cancer; 37(6):2719-2728 1976

Computerized (Axial) Tomography (CT) scans were evaluated for assessing cerebral tumors in 94 patients. Eight case studies illustrate successes and problems of the technique. A 38-yr-old woman was found to have a vascular tumor with edema. After treatment the scan showed no tumor, which was confirmed by the disappearance of clinical symptoms. A 38-yr-old man was found to have a glioma in the left fronto-parietal region. Post-treatment scans showed reduced tumor size, confirmed by disappearance of CNS symptoms. A 70-yr-old man was found to have a right anterior temporal tumor and edema. Post-treatment scans indicated central necrosis in the tumor and edema, though CNS symptoms disappeared. A 64-yr-old man was scanned and found to have a glioma in the left frontal region. Post-treatment scans indicated tumor shrinkage, consistent with disappearance of CNS symptoms. A 65-yr-old man had a glioma in the right parietal-occipital region and edema according to CT scan. Post-treatment scan showed an increasing tumor mass. Clinical symptoms disappeared but subsequently reappeared and the patient deteriorated. An 11-yr-old girl was found to have a tumor at the base of the skull. After-treatment scans showed edema, which was consisted with clinical symptoms. A 10-yr-old girl was found to have a glioma; this was confirmed by interventive techniques. A 65-yr-old man was scanned and a left temporal region tumor was diagnosed. Post-treatment scan revealed no evidence of lesion, despite continued clinical symptoms, but these subsequently disappeared. These data indicate that tumor presence and mass are not necessarily correlated with CNS symptoms, that edema can be distinguished from tumor mass by CT scan, and that necrosis is difficult to distinguish from edema with the CT scan. (3 refs)

230. THE USE OF COMPUTED TOMOGRAPHY FOR RADIATION THERAPY TREATMENT PLANNING.

Chernak ES, Rodriguez-Antunez A, Jelden GL, Dhaliwai RS, Lavik PS

Department of Radiation Therapy, The Cleveland Clinic, 9500 Euclid Avenue, Cleveland, Ohio 44106

Radiology; 117(3):613-614 1975

In this treatment planning method, information from total body scans is fed into a radiation therapy treatment computer, the Artronix PC-12 system with 16K core. By providing an accurate profile of the patient's anatomy, total body computed tomography may contribute greatly to the solution of complex treatment problems involving the head and neck, thorax and abdomen. (Author Abstract)

231. COMPUTED TOMOGRAPHY IN THE EVALUATION OF MALIGNANT GLIOMA BEFORE AND AFTER THERAPY.

Norman D, Enzmann DR, Levin VA, Wilson CB, Newton TH

Department of Radiology, University of California, San Francisco, Calif.

Radiology; 121(1):85-88 1976

Sixty-three patients with malignant glioma undergoing chemotherapy and radiotherapy were evaluated with electroencephalography, ^{99}mTc-DTPA imaging, and computed tomography (CT). Tumor size, central lucency, contrast enhancement, surrounding edema, and ventricular size were assessed. CT findings were found to be reliable and often predicted the clinical course. Tumor size, central lucency, and contrast enhancement increased in patients with clinical deterioration and decreased in those with improvement. The CT scan also provided additional information of value in adjunctive therapy, such as the presence of cysts or ventricular obstruction. In general, CT gave a more complete profile of tumor characteristics than other diagnostic modalities. (Author Abstract)

232. THE USEFULNESS OF COMPUTED TOMOGRAPHY DURING AND AFTER RADIATION THERAPY IN PATIENTS WITH BRAIN TUMORS.

Pay NT, Carella RJ, Lin JP, Kricheff II

Department of Radiology, Divisions of Neuroradiology and Radiation Oncology, New York University Medical Center, New York, N.Y.

Radiology; 121(1):79-83 1976

Two years of experience with 100 patients in the serial study of brain tumors during and after radiation therapy has shown that computed tomography is useful in (a) depiction of regression or growth of primary and metastatic intracranial tumors, (b) recognition of untoward sequelae of radiation therapy, such as necrosis and edema, and (c) appreciation of changes in tumor density and ventricular size. Representative cases are discussed and illustrated. (Author Abstract)

233. COMPUTERIZED (AXIAL) TOMOGRAPHY IN THE SERIAL STUDY OF CEREBRAL TUMORS TREATED BY RADIATION.

Carella RJ, Pay N, Newall J, Farina AT, Kricheff II, Cooper JS

Divisions of Radiation Oncology and Neuroradiology, Department of Radiology, New York University Medical Center, 566 First Avenue, New York, NY 10016

Cancer; 37(6):2719-2728 1976

The difficulty in evaluating the effectiveness of radiation therapy of primary cerebral tumors is well appreciated. Changes in tumor size and the presence or absence of edema or necrosis during or following treatment cannot be readily evaluated by present noninterventive roentgenographic methods. At New York University Medical Center, computerized (axial) tomography (CT) has been routinely used both before and after radiation therapy with the aim of assessing, by noninterventive means, tumor response, presence or absence of edema, or necrosis. A selected series of patients is presented with correlation of the clinical findings and CT-scan results both before and after therapy. The significance of these findings and their implications in the management of cerebral tumors are discussed. (Author Abstract)

234. RADIATION TREATMENT PLANNING.

Laughlin JS, Chu F, Simpson L, Watson RC

Memorial Sloan-Kettering Cancer Center, 1275 York Avenue, New York, NY 10021.

Cancer Suppl; 39(2):719-728 1977

Radiation treatment planning has developed into a substantial and effective component of the entire radiation treatment approach. Over the last 2 decades, with the development of high energy electron and x-ray sources, and also with the availability of new radionuclides and techniques for internally applied radiation, all of which permit a high degree of concentration of radiation, treatment planning has been developed to make best use of these modalities. The use of automatic computation has proved necessary in order to handle the large amounts of radiation data involved in treatment dose calculation. Tumor and anatomical localization has been carried out with increasing precision. Several cases are described which illustrate planning and in particular the use of computerized transverse tomography. The use of moving shadow-shields is also described. For internally ap-

plied radiation, the features of iodine-125 are illustrated. (13 Refs) (Author Abstract)

235. THE EVOLVING ROLE OF COMPUTERIZED TOMOGRAPHY IN RADIATION ONCOLOGY.

Rockoff SD
Department of Radiology, The George Washington University Medical Center, Washington, D.C.
Cancer Suppl; 39(2):694-696 1977

The development and application of computerized tomography of the body have important implications in the diagnosis of tumors and in the planning of the radiotherapy treatment of malignancies because the modality provides: a) an exact contour of transverse sections of the body; b) distinct representation of anatomic internal structures; c) ability to diagnose the presence and extent of tumor involvement of internal organs; d) opportunity to obtain, quantitatively, the "density" (x-ray absorption) of the anatomical structures in the sections; e) capability to develop isodose curves with inhomogeneity corrections; and f) ability to follow the response of a tumor to treatment, non-invasively. Although the diagnostic efficacy of computerized tomography of tumors, relative to other diagnostic modalities, is still to be defined accurately and the exact role of this new method in radiotherapy treatment planning is still to be determined, computerized tomography appears to provide oncologists with a valuable adjunct in their management of tumor patients. (7 Refs) (Author Abstract)

C. Role in Chemotherapy

236. CRITERIA FOR EVALUATING PATIENTS UNDERGOING CHEMOTHERAPY FOR MALIGNANT BRAIN TUMORS.

Levin VA, Crafts DC, Norman DM, Hoffer PB, Spire JP, Wilson CB
Brain Tumor Res. Center, Dept. Neurological Surgery, Univ. California Sch. Medicine, San Francisco, CA
J Neurosurg; 47(3):329-335 1977

The authors describe their criteria for evaluating brain-tumor patients, and present a numerical rating scale devised to designate response to testing. They discuss the reliability of test combinations that permit accurate prediction of response or deterioration during therapy in their experience with 100 patients treated on the Chemotherapy Service at the Brain Tumor Research Center, University of California, San Francisco School of Medicine. Specifically, the paper summarizes the predictive value of the neurological examination, radionuclide scintiscan, computerized tomographic brain scan (CT scan), and electroencephalogram (EEG), in the determination of response (tumor regression) or deterioration (tumor growth) during brain-tumor chemotherapy-radiotherapy. By retrospective analysis, the neurological examination, radionuclide scintiscan, and CT scan were of equal value individually as tests to predict response to therapy. However, the prognostic values of the neurological examination or the radionuclide scintiscan proved moderately superior to the CT scan in predicting deterioration during therapy. Under circumstances whereby a neurological examination, radionuclide scintiscan, and CT scan were all performed during the same testing session, and steroid dosage was carefully monitored, two of the three tests accurately predicted deterioration in 65% of patients, and response to therapy in 82% of patients. Two of the three tests correctly established deterioration in the remaining 35% of patients, and response in the remaining 18% of patients, when the two positively correlated tests had occurred within a mean period of 7 wk. (Author abstract) (5 Refs)

237. CHEMOTHERAPY BEFORE RADIOTHERAPY IN THE TREATMENT OF MALIGNANT GLIOMAS OF THE CENTRAL NERVOUS SYSTE' 'CNS) (MEETING ABSTRACT).

Avellanosa AM, Higby DJ, West CR
Roswell Park Memorial Institute, Buffalo, N.Y. 14263
Proc Am Assoc Cancer Res; :275 1976

From 12/1/74 to 12/15/75, 12 patients ages 30-69 years with malignant gliomas of the CNS were treated with MeCCNU 130 mg/m² pc and Oncovin 2 mg/m² iv on day 1 and Procarbazine 100 mg/m² po on days 2-15 every 6 weeks. Treatment was given 7-20 days following excisional biopsy of the brain tumor, except in one patient who had had previous radiotherapy 2 1/2 years before recurrence. The remaining patients had no previous radiation therapy nor chemotherapy. The tumors in all patients were supratentorial. Histological diagnosis included: astrocytoma, grades II-III in 3, astrocytoma, grades III-IV in 8 and oligodendroglioma in 1. One patient died of pneumonia 4 weeks following initiation of therapy (not drug related), and 4 are as yet too early to evaluate. Seven patients completed 3-6 cycles of treatment with a followup of 4-12 months. Objective responses continue in 5 patients with decrease in tumor size measured by sequential brain scanning and computerized axial tomography. In these, pretreatment steroid doses remain the same or have been adjusted downward. The other two developed cystic tumor necrosis following 3 and 4 courses. Toxicity was acceptable and chiefly hematologic. Preliminary results of the use of chemotherapy before radiotherapy in the treatment of malignant gliomas suggest that our approach is promising and warrants further study. (Author Abstract)

238. COMPUTED TOMOGRAPHIC APPEARANCE OF METHOTREXATE-INDUCED NECROTIZING LEUKOENCEPHALOPATHY.

Bjorgen JE, Gold LH
Department of Radiology, University of Minnesota Hospitals, Minneapolis, Minn.
Radiology; 122(2):377-378 1977

A case of methotrexate induced brain damage is presented. Computed tomography (CT) demonstrated a high-density mass lesion with a low-density area in the white matter which pathologically represented a large area of acute necrotizing cerebritis. CT appearance was indistinguishable from brain abscess. (Author Abstract)

239. ABNORMAL COMPUTED TOMOGRAPHY (CT) SCANS IN CHILDREN WITH ACUTE LYMPHOCYTIC LEUKEMIA (ALL) FOLLOWING CNS PROPHYLAXIS. (MEETING ABSTRACT).

Peylan-Ramu N, Poplack DG, Pizzo PA, Di Chiro G
Pediatric Oncology Branch, NCI and Neuroradiology Section, NINCDS, N.I.H., Bethesda, Md. 20014
Proc Am Soc Clin Oncol; 18:305 1977

37 asymptomatic patients (pts.) with ALL who had been randomized to receive CNS prophylaxis consisting of 2400 R cranial irradiation (CR) and either intrathecal (I.T.) methotrexate (MTX) (12 mg/m²) or I.T. cytosine arabinosine (Ara-C) (30mg/m²) were recalled for CT scanning 20-67 months following the initiation of prophylaxis. 13/37 pts. (35%) had one or more abnormal CT scan findings which included dilated ventricles, areas of decreased attenuation coefficient in white matter (demyelination) and intracerebral calcifications. The only abnormality found in the 18 pts. who had received CR plus Ara-C was ventricular dilatation (5 pts.). However, of the 19 pts. in the CR plus MTX group, 2 had dilated ventricles, 1 had areas of decreased attenuation, 3 had both, and 2 had intracerebral calcifications. Areas of decreased attenuation coefficient in white matter and intracerebral calcifications have been associated with

methotrexate leukoencephalopathy. These unanticipated CT scan findings in a group of patients who have undergone CNS prophylaxis are of concern. The ability of CT scanning to detect such abnormalities suggests that this diagnostic modality may be useful in monitoring patients who have undergone CNS treatment. (Author Abstract)

240. COMPUTED TOMOGRAPHIC APPEARANCE OF METHOTREXATE-INDUCED NECROTIZING LEUKOENCEPHALOPATHY.

Bjorgen JE, Gold LH
Dept. Radiology, Univ. Minnesota Hospitals, Box 292-Mayo, Minneapolis, MN 55455
Radiology; 122(2):377-378 1977

A case history of a methotrexate (MTX)-induced leukoencephalopathy demonstrated by computed tomography (CT) is summarized. A 39-yr-old woman with a 4-yr history of chronic myelogenous leukemia, associated with a positive Philadelphia chromosome, experienced full remission under vincristine and prednisone. Craniospinal irradiation was subsequently administered to a total dose of 2,000 rads during 2 mo. The onset of headaches several mo later was associated with the presence of blast cells in the cerebrospinal fluid (CSF). Intrathecal MTX (15 mg) was administered 2 x/wk via an Ommaya reservoir in the right lateral ventricle; there were 10 doses, with leucovorin rescue. The patient had been maintained on 6-mercaptopurine and MTX (30 mg, po) weekly and vincristine (3 mg, iv) monthly. There were no focal neurologic signs, the Hb was normal, and the WBC count was 5,800 with a normal differential. The CSF had neither cells nor blood and the marrow was normal. A CT scan found a marked midline shift of the ventricles to the right, revealing a large, high-density mass in the left frontal lobe after contrast enhancement. At surgery a large, rubbery mass was localized in the frontal lobe, with no well-defined demarcation. Histologically, the tissue, which resembled a low-grade glioma, showed necrotizing cerebritis with acute vascular inflammation, diffuse edema, and reactive gliosis. The single large lesion in this patient might have been related to the high concentration of MTX near the shunt tip. (11 refs)

241. LEUKOENCEPHALOPATHY FOLLOWING CHEMOTHERAPY FOR RHABDOMYOSARCOMA: REVERSIBILITY OF CEREBRAL CHANGES DEMONSTRATED BY COMPUTED TOMOGRAPHY.

Fusner JE, Poplack DG, Pizzo PA, Di Chiro G
Pediatric Oncology Branch, NCI, Building 10, Room 3B06, 9000 Rockville Pike, Bethesda, MD 20014
J Pediatr; 91(1):77-79 1977

A case report of leukoencephalopathy in a 4-yr-old boy following methotrexate chemotherapy for rhabdomyosarcoma is presented. Computed tomography (CT) was used to diagnose this condition instead of the usual histopathologic examination. CT scanning may provide a non-invasive, early indication of methotrexate-associated leukoencephalopathy. (9 Refs)

XI. RADIATION EXPOSURE DOSIMETRY

242. CLOUD CROSSES X-RAY SCANNER'S BLUE SKY.

Anonymous
No affiliation given
New Sci; 71(1015):440 1976

The US Area Health Authorities suspended all purchases of brain and body scanners to allow the health planning agencies to study applications of new equipment in particular hospitals. There is controversy over the report that the x-ray dosage levels are above those allowable using conventional techniques. EMI, the world market leader in this field, has denied the report. The high cost of the scanner is balanced by studies showing that savings in patient beds and expenditures on alternative types of patient examination far outweigh the running costs of the scanner. No regulations for the use of the computerized axial tomography equipment yet exists in the US, although EMI is cooperating with the FDA in the formulation of such regulations. Clinical evidence amassed from the users of the EMI brain scanner suggests that the x-ray exposure involved in conventional examination is far greater than that given using the brain scanner. In many brain examinations, up to 40 direct exposures are needed using conventional techniques to obtain the same information given by a single brain scan. Any comparison of the two techniques must also be based on the returns in terms of information received.

243. MEASUREMENT OF THE ABSORBED DOSE TO THE PATIENTS BY COMPUTERIZED WHOLE-BODY X-RAY TOMOGRAPHY WITH THE AID OF THERMO-LUMINESCENCE DOSIMETERS IN AN ALDERSON-PHANTOM.

Krauss O, Schuhmacher H
Dtsch. Krebsforschungszentrum, Institut fuer Nuklearmedizin, Strahlenschutz und Dosimetrie, Im Neuenheimer Feld 280, D-6900 Heidelberg 1, W. Germany
Radiologe; 16(7):288-293 1976

The radiation dose for brain, lung, liver, and kidney examinations which were performed with computerized wholebody scanner was measured by LiF-TLD in the Alderson-Phantom. The absorbed skin dose to the trunk by a single scan (filtration 6 mm Al) was found to be 1.2 rads at the entrance and 90 millirads at the exit. Patient investigations were simulated with a series of five scans. The maximum abdominal entrance dose was 1.8 rads, 700 millirads at the body axis and 250 millirads near the exit. The dose to the gonads was less than 2 and 4 millirads if the distance was more than 15 cm between the last scan and the gonads. Scattered radiation in the Delta-Scan room during an investigation was 1.5 milliR/scan and 0.3milliR/scan for a distance of 1 meter and 2 meter from the irradiated vol.

244. RADIATION DOSE TO THE HEAD, AND PARTICULARLY TO THE LENS OF THE EYE, DURING AXIAL TOMOGRAPHY WITH EMI SCANNER.

Nemec HW, Roth J
Universitatsinstitut fur Medizinische Radiologie, Abteilung fur Radiologische Physik, Kantonsspital, CH-4004 Basel, Switzerland
Fortschr Geb Roentgenstr Nuklearmed; 124(6):526-530 1976

Radiation dose to the lens of the eye was estimated using thermoluminescence and film dosimetry on phantoms and on patients undergoing computerized axial skull tomography with the EMI scanner. The dose decreased from the lateral margin of the right eye to the lateral margin of the left eye. During conventional three layer tomography, maximal exposure to the eye produced entirely by scatter was about 0.6 R (1.55 x 10**-4 C.kg**-1). Direct irradiation of the plane of the orbits produced a maximal exposure rate of 3 R (7.7 x 10**-4 C.kg**-1). Maximal dose to the head depended on skull size and was about 4 R (approx 10**-3 C.kg**-1). The local dose dependence of the eyes was confirmed theoretically by drawing up a computer program, and was related to the method used by the EMI scanner.

245. EXPOSURES TO PATIENT AND PERSONNEL IN COMPUTED AXIAL TOMOGRAPHY.

Shrivastava PN, Lynn SL, Ting JY
Div. Radiologic Physics, Allegheny General Hosp., 320 E. North Ave., Pittsburgh, PA 15212
Radiology; 125(2):411-415 1977

Distribution of radiation exposure circumcranially for patients undergoing brain scanning with EMI computed tomographic equipment was measured using thermoluminescent dosimeters. The exposures are found to lie in the range of 1-5 R depending on position relative to tube motion. The max exposure of 5 R in computed tomography (CT) scanning lies between the estimated exposure of 1.2 R for skull radiography and approx 10 R for angiographic examination. Measured exposures are reported corresponding to locations of the patients' eyes, thyroid, chest and gonads, and at various locations in the vicinity of the unit. (Author abstract) (14 Refs)

XII. POSITRON, PROTON, AND GAMMA SCANNING

246. POSITRON EMISSION IMAGING TECHNIQUES: A COMPARISON OF VARIOUS CAMERA SYSTEMS.

Cronin MP
No affiliation given
Appl Radiol; 6(3):219-221,237 1977

A comparison of various camera systems for use in positron emission tomography is presented. The most important parameters for a good system are the utilization of annihilation photons in a coincidence mode and imaging the significant areas in the random access mode. A camera system based on coincidence detection of the 511-kilo-electron volt annihilation photons that follow positron decay is discussed as incorporating the two basic parameters efficiently. (no Refs)

247. RADIOISOTOPES IN POSITRON TOMOGRAPHY.

Cronin MP
No affiliation given
Appl Radiol; 6(5):189,192,208 1977

Scintigraphic imaging by positron-emitting radioisotopes, especially in the area of three-dimensional tomography of physiological processes, is reviewed. Cyclotron-produced isotopes are compared with those pr duced by generators. Commonly used foreign isotopes include Tc99m, F18 and I131, while the most commonly used natural isotopes are C11, N13 and oxygen 15. Cost factors are also discussed. (no Refs)

248. APPLICATION OF ACCELERATED HEAVY IONS AND POSITRON EMITTERS TO DIAGNOSTIC IMAGING.

Iinuma T
Div. Clinical Res., Natl. Inst. Radiological Science, Anagawa, Chiba, 280, Japan
Jpn J Cancer Clin; 23(4):373-377 1977

In this paper, the following three topics are introduced concerning the diagnostic applications of particle accelerators: (1) heavy-ion radiography and autoactivation by Dr Tobias, (2) He-ion transmission transaxial tomography by Dr Crowe and (3) circular ring transaxial tomography using positron annihilation coincidence by Drs Cho and Budinger. The present state of the art and future aspects are briefly discussed. (Author abstract) (9 Refs)

249. TUMOR LOCATION WITH 1-AMINOCYCLOPENTANE ^{11}C CARBOXYLIC ACID: PRELIMINARY CLINICAL TRIALS WITH SINGLE-PHOTON DETECTION.

Hubner KF, Andrews GA, Washburn L, Wieland BW, Gibbs WD, Hayes RL, Butler TA, Winebrenner JD
Medical and Health Sciences Div., Oak Ridge Associated Universities, P.O. Box 117, Oak Ridge, TN 37830
J Nucl Med; 18(12):1215-1221 1977

High specific activity C^{11} carboxyl-labeled 1-aminocyclopentane-carboxylic acid (C^{11}-ACPC) was tested as a tumor-scanning agent in 38 patients. This artificial amino acid clears the blood to a level of less than 12% within 45 min; thus, imaging is possible within the useful life of C-11. C^{11}-ACPC can be produced in amounts adequate for clinical scanning. Doses between 12 and 45 mCi were given by iv injection, and scans obtained only in the single-photon mode gave clinical information on the sites of tumors. There was no evidence of any toxic effects from C^{11}-ACPC, and the radiation doses as extrapolated from animal data are approx 0.01 rad per mCi for the whole body and less than 0.06 rad per mCi for the pancreas. In all but 5 of the 38 patients, C^{11}-ACPC scans were compared with those obtained with Ga-67 citrate. There were 19 positive C^{11}-ACPC scans and 24 positive Ga-67 scans. The results indicate that C^{11}-ACPC is likely to be of diagnostic value for cancer patients if used in conjunction with positron tomography instrumentation. (Author abstract) (14 Refs)

250. CYCLOTRON-PRODUCED ZN-62: ITS POSSIBLE USE IN PROSTATE AND PANCREAS SCANNING AS A ZN-62 AMINO ACID CHELATE.

Yano Y, Budinger TF
Donner Lab, Univ. California, Berkeley, CA 94720
J Nucl Med; 18(8):815-821 1977

Zinc-62 is a positron emitter that localizes in pancreas, prostate, and liver. Cyclotron-produced Zn62 was separated by column chromatography and evaluated in vivo as the chelate of five amino acids and also as Zn62Cl2. Tissue-distribution studies were done in normal animals from 0.7-23 hr after iv administration. Pancreas-to-liver ratios (per g) of about 1.0 were found at 1.5 hr in studies on rats, dogs, and monkeys. Pancreas was as difficult to separate from liver in Zn62 (amino acid) images as in Sc75 selenomethionine images. Some studies were done with Zn65 to determine the effects of carrier zinc and molar ratios of ligand. The highest ratio of pancreas to liver in these studies was 1.44. This uptake ratio decreases with increasing amounts of histidine, but the ratio is increased by adding carrier zinc because there results a decrease in liver uptake and no change in the pancreas uptake. There is sufficient specificity of pancreas and prostate uptake to make feasible emission computed tomography with Zn62. (Author abstract) (14 Refs)

251. FIRST CLINICAL EXPERIENCES WITH AXIAL EMISSION COMPUTER TOMOGRAPHY.

Feine U, Anger K, Muller-Schauenburg W, Milward RC
Abteilung fur Nuklearmedizin am Medizinischen Strahleninstitut der Universitat, Rontgenweg 11, 7400 Tubingen, W. Germany
Fortschr Geb Roentgenstr Nuklearmed; 127(4):358-365 1977

Clinical experience with axial emission computer tomography on 81 patients is described. The scanner makes 30 transverse computer-guided profiles at the rate of 6 per 180 degrees. The scanning time, at a scan-speed of 1.5 cm/sec, was 10 min. Layer scintigrams included 25 of brain, 30 liver-spleen, 12 renal, 8 bone, and 3 other scintigrams (lungs, heart). The brain scintigraphy was done with 1 mCi Tc99m/10 kg body wt, "pi" over a period of 30-50 min. Questionable findings on

the sectioned brain scintigram, in cases where a general scintigram showed negative results, were attributed to artifacts. The sectioned brain scintigram was able to confirm either positive or negative findings from the general scintigram, and aided in the differential diagnosis of positive results (eg, to separate meningiomas from glioblastomas). Additional information from the brain scintigraph using sectional examinations was available in 48% of the cases. The liver scintigraphy was done with 1 mCi Tc99m-S-colloid, 30 min; "pi" sectional examinations provided additional information in 33% of the patients in the form of improved intrahepatic localization and delineation of tumors. Renal scintigraphy was performed with 4 mCi Tc99m-Rolitetracycline, 1 "hpi". No additional information was provided by renal axial emission computer tomography. (29 Refs)

252. DIAGNOSTIC VALUE OF COMPUTERISED ISOTOPIC SECTION RENAL SCANNING.

MacDonald AF, Keyes WI, Mallard JR, Steyn JH
Dept. Radiology, Univ. Aberdeen, Aberdeen, Scotland
Eur Urol; 3(5):289-291 1977

The results obtained with computerized isotopic section renal scanning are discussed and its uses defined. The isotope used was technetium labelled dimercaptosuccinic acid, of which 60% of the administered dose goes to the kidneys. There it is concentrated in the parenchyma with a cortex to medulla ratio of 17:1, giving good definition of small cortical lesions. The scanning is performed on a dual detector radioisotope scanner which rotates 180 degrees. The technique is similar to the transverse computer-assisted tomography x-ray technique. The x-ray technique demonstrates anatomy and pathology while the isotope technique demonstrates anatomy and function. The normal renal scan shows the shape, size, and position of the renal substance fairly accurately on each side. Renal cysts are well-differentiated from normal tissue on a standard view of the isotope scan. Lesions in polycystic kidneys are also sharply delineated; in addition, the actively functioning parts of the renal parenchyma are demonstrated. Metastatic tumors of the kidney present a somewhat confusing appearance. (4 Refs)

253. NON-COMPUTERIZED OFF-AXIAL TOMOGRAPHY WITH 580 MEV PROTONS. (PP. 471-473)

Dubal L
Seventh International Conference on Cyclotrons and their Applications, Zurich, Switzerland, 19-22 August 1975. Swiss Federal Institute of Technology, Zurich and International Union of Pure and Applied Physics Zurich Switzerland, 1975.

The use of non-computerized off-axial tomography is reviewed. Tomography uses a passive property of radiation absorption, ie, variation of the transmission rate. Computerized tomography reconstructs (Fourier analyses) a two dimensional picture out of a sequence of one dimensional transmission profiles, the resulting image being axially oriented. The use of the stereoscopic effect of two views of the same object (slice) taken at two slightly different angles is, in such a case, not feasible. Protoscopy, in contrast, is based on an active property of radiation absorption, ie, large angle nuclear scattering. The vertices of the large angle scattered protons are individually measured. The spatial resolution of the detectors and the Coulomb multiple scattering are responsible for the existence of an elementary volume. Stereo display is under study. Although protoscopy requires an expensive proton source of 600 MeV, a scanning system, the protoscope, is proposed to challenge all the excellent performances of the most advanced x-ray tomography techniques such as the automatic computerized transverse axial (ACTA)-scanner.

254. PROTON RADIOLOGY WITH A 600-MEV ACCELERATOR.

Dubal L
Swiss Inst. Nuclear Res., Villigen, Switzerland
Atomkernenergie; 27(3):189-192 1976

Particle radiography may have a biomedical usefulness in that nuclear scattering offers direct access to three-dimensional density information. The problem of lack of speed in this technique, using a 600 million electron volt (MeV) proton beam, may be overcome by using a very narrow collimated beam. Use of a narrow beam allows the calculation of the position of the vertices along the beam axis by simple geometry. Therapyscopy and synthetic tomography are discussed. Protoscopy, a recently proposed non-invasive technique for fast tomography should allow, for a one-rem dose only, the detection of tumors as small as 5 mm in diameter. The synthesis of a tomodensitogram will be done in a similar way to the synthesis of an echotomogram. The experimental apparatus and the very fast data handling system will detect and record the large angle scatters from the intense and narrow SIN 600-MeV proton beam scanning the specimen. Sets of cytograms (density profiles along the beam axis) are thus obtained. Exposure to radiation can be limited to the vol under examination.

255. CARBON-11-LABELED METHYLATED POLYAMINE ANALOGS: UPTAKE IN PROSTATE AND TUMOR IN ANIMAL MODELS.

Welch MJ, Coleman RE, Straatmann MG, Asberry BE, Primeau JL, Fair WR, Ter-Pogossian MM
Mallinckrodt Institute of Radiology St. Louis, Missouri
J Nucl Med; 18(1):74-78 1977

The polyamines putrescine, spermine, and spermidine were methylated by the addition of carbon-11-labeled formaldehyde followed by sodium borohydride. High labeling yields were obtained and the final products were purified by simply boiling the solution. This decomposed the excess sodium borohydride and removed the volatile impurities. The final radiochemical purity of all the methylated compounds was above 85%. All three methylated compounds accumulated in the prostates of male rats and the distribution of N-methyl-1,4-diaminobutane (the putrescine analog) was very similar to that previously obtained with tritiated putrescine. The uptake of the putrescine analog in both the prostate and in mouse tumor was slightly higher than that obtained with the other two analogs studied. Utilizing a positron transaxial tomographic scanner and the putrescine analog, we have been able to image the prostate gland of a dog. (Author Abstract)

256. RADIONUCLIDE EMISSION COMPUTED TOMOGRAPHY OF THE HEAD WITH ^{99m}TC AND A SCINTILLATION CAMERA.

Jaszczak RJ, Murphy PH, Huard D, Burdine JA
Searle Analytic Inc., Des Plaines, Il
J Nucl Med; 18(4):373-380 1977

To investigate the potential application of radionuclide computed tomography (RCT) to nuclear medicine imaging using ^{99m}Tc, a tomographic system using a lightweight scintillation camera for brain imaging was constructed, and lesion contrast with RCT and conventional scintigraphy were compared. The detector revolves once around the patient's head at constant angular velocity, requiring approximately 20 min. Nine sections are reconstructed from the data, using either a Fourier transform or a filtered back-projection algorithm. In a phantom simulating the radionuclide distribution observed during brain imaging, quantitative lesion contrast was far superior in the RCT images. In a series of 25 patients with intracranial lesions, the average RCT lesion contrast was superior to that of standard scintigraphy by a factor of more

than 2. An RCT image of an experimentally infarcted dog's heart, taken after the injection of ^{99m}Tc-MAA into the left atrium, also showed excellent correspondence to the gross anatomic defect. Although problems of photon absorption may occur in imaging larger body areas, RCT imaging in this feasibility study produced surprisingly good results that warrant further investigation of the technique. (18 Refs) (Author Abstract)

257. CLINICAL USES OF SCINTI-TOMOGRAMS PRODUCED BY A SCINTILLATION CAMERA.

Arimizu N

Natl. Inst. Radiological Sciences, Chiba, Japan

Nippon Acta Radiol ; 35(3) 142-151 1975

Overlapping of images often makes difficult the differentiation of the target lesion from superimposed nearby tissues. The scinti-tomogram has been developed for this differentiation. Recent reports mention that tomographic images are attainable by utilizing a standard scintillation camera with replaceable attachments. In the present work a study was made of the clinical application of scinti-tomograms to the brain and the liver. The instruments consisted of a scintillation camera, having an NaI crystal 38.7 cm in diameter, coupled with a 30 degree-angled 2000-parallel-hole collimator. The scinti-tomogram was produced by simultaneous rotational movements of both the collimator and the patient table in a period of 1-2 min. The resolution of tomographic images was examined by using a lead-bar phantom with Co57 sources. The 9.5 mm bars, placed 10 cm distant from the collimator, were discriminated when the tomographic layer coincided with the bars. Discrimination of the bars was not obtained on the scinti-tomogram when the tomographic layer was 1 cm apart from the bars. Clinical investigations were attempted on 70 patients with brain disease. In brain scintigraphy, radioactivity is not only accumulated in the brain lesion with a variety of densities, but it also concentrates in the dural sinuses, temporal muscles, and base of the cranium; frequently producing images superimposed on those of brain lesions. In many cases, tomographic images were effective in separating superimposed images from target images and were helpful in discerning more accurately the , location, extent and size of the lesions. Cases were frequently encountered with the lesion neighboring the cranial floor, and the scinti-tomogram was worth performing. Liver scinti-tomograms of the patient were illustrated, suggesting their usefulness for understanding the three-dimensional extent of the liver. (10 refs)

258. BRAIN SCANNING WITH THE ANGER MULTIPLANE TOMOGRAPHIC SCANNER AS A PRIMARY EXAMINATION.

Turner DA, Ramachandran PC, Ali AA, Fordham EW, Ferry TA

Departments of Nuclear Medicine and Radiology, Rush-Presbyterian-St. Luke's Medical Center, and Rush Medical College, Chicago, Ill.

Radiology; 121(1):125-129 1976

A commercial prototype of the Anger multiplane tomographic scanner was compared with a scintillation camera, in terms of observer performance, as a primary instrument for brain scintigraphy. Observer performance (diagnostic accuracy), expressed as ROC curves, was slightly better when reading the tomographic scans than when reading the camera images. In brain scintigraphy of a general population, the scanner has a small advantage over the scintillation camera. This advantage is directly proportional to the fraction of cases in which there is difficulty differentiating intracranial lesions from superficial foci of activity on the camera image. (Author Abstract)

259. BRAIN SCANNING WITH THE ANGER MULTIPLANE TOMOGRAPHIC SCANNER AS A SECOND EXAMINATION.

Turner DA, Fordham EW, Pagano JV, Ali AA, Ramos MV, Ramachandran PC

Departments of Nuclear Medicine and Radiology, Rush-Presbyterian-St. Luke's Medical Center, and Rush Medical College, Chicago, Ill.

Radiology; 121(1):115-124 1976

One hundred and one patients (43 abnormal, 58 normal) were re-examined with a commercial prototype of the Anger multiplane tomographic scanner after brain scintigraphy. The studies were interpreted independently by four observers of varying experience. Observer performance, in terms of ROC curves, was substantially better when interpreting the tomographic brain scans and camera scintigrams together or the tomographic scans alone than when interpreting the camera images alone. Re-examination with the scanner increases the accuracy of brain scintigraphy (observer performance) in cases in which there is difficulty distinguishing intracranial lesions from superficial foci of activity by camera scintigraphy alone. (Author Abstract)

260. CARBOHYDRATES AS POTENTIAL DIAGNOSTIC TRACERS FOR BRAIN TUMORS.

Wassenaar W, Tator CH

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J Neurosurg; 44(6):668-676 1976

Currently available diagnostic tracers for brain tumors are not specific. Tumor-specific tracers would improve the detection of brain tumors by gamma encephalography. Glucose is an important substrate for tumor metabolism and is known to be taken up in large amounts. The authors have studied five labeled carbohydrates in an attempt to find a tumor-specific tracer: three were tritiated (L-galactose-1-^{3}H, L-fucose-^{3}H, and 4,6-dideoxy-xylo-hexose-^{3}H) and two were radioiodinated (methyl-6-^{125}I-6-deoxy-D-glucoside and 6-^{125}I-6-deoxy-D-glucose). The uptake of these tracers by a transplantable mouse ependymoblastoma after intravenous injection was determined by liquid and well scintillation counting. The highest tumor-to-brain ratio was 7.1 to 1 for the tritiated tracers and 6.2 to 1 for the radioiodinated tracers. Although these ratios are not high enough for gamma encephalography, one of the iodinated tracers may be useful for enhancement of contrast in computerized axial tomography. (Author Abstract)

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